The Study of the Symbiotic Relationship between Pedestrian Systems and Buildings in High-Density Cities

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We certify that we have read this Doctorate Project and that, in our opinion, it is satisfactory in scope and quality in fulfillment as a Doctorate Project for the degree of Doctor of Architecture in the School of Architecture, University of Hawai'i at Mānoa.

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ABSTRACT

Traffic systems are so important that they shape the form of cities. And yet the growing number of vehicles in high-density cities creates a situation that places pedestrians in direct competition with vehicles for space, especially in city centers. Current methods, such as underground and elevated walkways, are just passive measures. They do not integrate pedestrian, vehicular and building systems and therefore are not conducive to a city's street life. At best, these systems still leave pedestrian traffic intermittent and discontinuous, instead of streamlining the flow of people and goods.

Buildings play vital roles in urban space, such as offering public space within buildings, supporting the function needed by the public, improving the environment of public space, and working as nodes to reconcile the contradiction between vehicles and pedestrians. In order to implement these roles, a symbiotic relationship between pedestrian systems and buildings is required. Currently in China, functions are highly concentrated in city centers and cities are developing towards a high-density, which leads to the development of three-level traffic systems especially in city centers. In the process of weaving together new building and traffic infrastructure, China has a great opportunity to establish pedestrian systems that are integrated with buildings.

The main work of the paper is listed below:

(1) With the analysis of the successful pedestrian systems of Hong Kong, Bangkok and Boston, I summarized a variety of connection methods between buildings and pedestrian systems, as well as several ways that multi-function buildings support pedestrian systems. After that, the Assessment Methodology was proposed in terms of the three precedents together with related theories.

(2) By implementing the Assessment Methodology on three city centers in Shanghai (Wujiaochang, Yangpu District, Lujiazui, Pudong District and Xujiahui, Xuhui District), I summarized the merits and demerits of each urban center.

(3) I proposed the design strategy for the symbiotic relationship between pedestrian systems and buildings on the basis of previous analysis of Hong Kong, Bangkok and Boston, together with the three city centers in Shanghai.

(4) Basing on the 5 design strategies, I proposed a design for one site within Wujiaochang. I integrated buildings and pedestrian systems to create a convenient,

desirable and dynamic place for pedestrians, as well as solve the existing challenges of pedestrian systems in the entire area.

The symbiotic relationship between pedestrian systems and buildings is to clarify the role of buildings in pedestrian systems, allowing buildings to serve as essential nodes, and integrate with the pedestrian systems. Thus, it would contribute to the continuity of pedestrian behavior and offer functional support, enhance the efficient and comfort level for pedestrian, stimulate more socializing and activities in public space, and therefore will improve the street culture. Especially in high-density cities, buildings can be utilized to interconnect the pedestrian systems on elevated, ground, and underground levels, contributing to safe, convenient and desirable walking environment. Hence the symbiotic relationship between pedestrian systems and buildings will help to address the problems found in existing pedestrian systems within high-density cities.

Key Words: high-density, city center, pedestrian system, building space, symbiotic relationship

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Chapter 1 Introduction

1.1 Background

1.1.1 Domination of Cars

With accelerating urbanization, the role of vehicles is increasingly important. They shape the structure of cities, and support the rapid development of cities. Using Shanghai as an example, it can be seen from the chart that private car ownership in Shanghai has been rapidly increasing in recent years, from 4,203 in 1988 to 865,000 in 2010. (Figure 1.1)

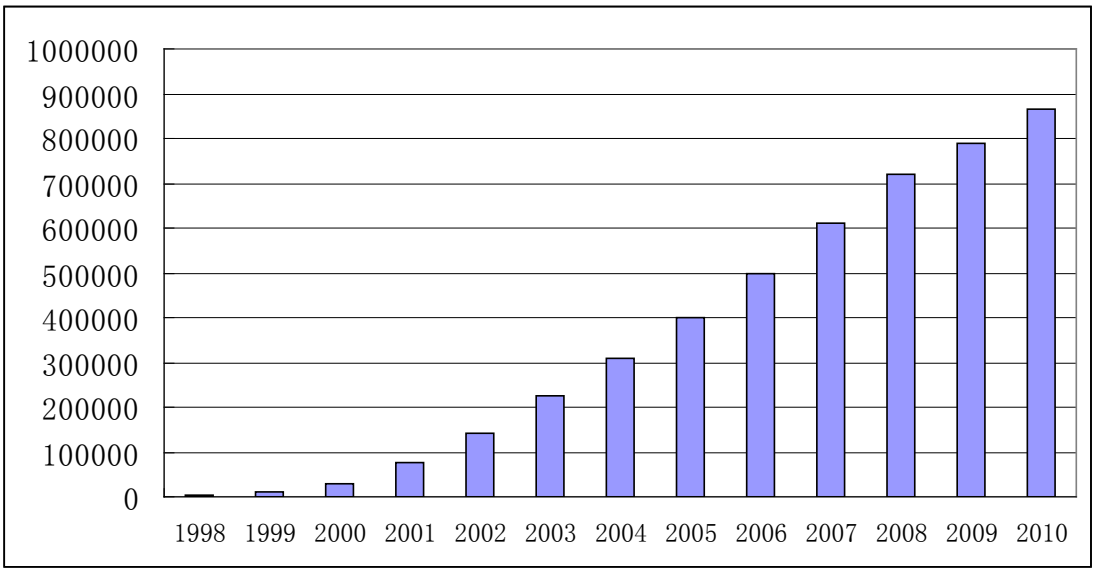


Figure 1.1

The increasing number of vehicles also creates numerous problems, especially in the city centers. Traffic congestion becomes a common phenomenon during peak hours (figure 1.2). The conflict between pedestrians and vehicles is becoming more and more fierce, as evidenced by the increasing number of traffic accidents, and wider traffic roads, which greatly reduces the quality of pedestrian space. Taking Shanghai Siping Road as an example, the width of the road was changed many times. Originally the width was 40m. Then in 2004, the structure of the

Figure 1.2

road was altered from 4(traffic lane)+2(bicycle lane)+2(walking lane) to 5+2+2. While in 2006, the road structure became 8+2+2, and the width grew close to 50m. The over-wide road tremendously narrowed the walking space (figure 1.3). Thus, without basic guarantee on the width of walking space, we are not able to mention the quality of pedestrian space.[1]

Figure 1.3

1.1.2 Degradation of Urban Environment

The *Chinese Prevention of Vehicles Pollution Report*[2] first published the pollutant emission by vehicles in China in 2010. It showed that China had become the biggest country that manufactures and purchases cars, and at the same time, traffic emissions contributed most to the air pollution in the metropolis. According to environmental monitoring, the air quality in 1/3 cities of 113 environmental protection cities has not achieved the standard level in 2009.

In recent years, the Shanghai government is paying more attention to protecting and curing the environment, and we are glad to see that the air quality is getting better. But the amount of PM2.5 in air is still far more beyond the standard level, which is almost 4 times higher than what the World Health Organization allows. Traffic emission is one of the most important factors that cause poor air quality.[3] In addition, Prof. Zhuang Guoshun[4] believes that the percentage of nitrate and sulfate in the air of Shanghai is the highest in China, which demonstrates that traffic pollution is the main pollution source in Shanghai. Air pollution directly threatens our health, and has a negative effect on our daily life. (figure 1.4)

Figure 1.4

1.1.3 Fading of Street Dynamic

Streets are an important portion of urban public space. In *The Dynamic Development of Urban Public Space*[5], Sun Tongyu proposes that cities and buildings

[1] Guan Zhirong, Lu Jiwei. *Study on the People-centered Strategies of Traffic Efficiency-oriented Urban Street：From the Perspective of Integrating Motor Traffic and Pedestrian Activities.* Urbanism and Architecture，2011(10)
[2] Vehicle Pollution Control Report of China (2010).
[3] http://scitech.people.com.cn/GB/16354891.html, Last modified: 2011/11/23.
[4] Zhuang Guoshun. *The ion chemistry, seasonal cycle, and sources of PM2.5 and TSP aerosol in Shanghai.* atmospheric environment, 2011
[5] Sun Tongyu. *The Dynamic Development of Urban Public Space.* Urban Planning, 2012 (05)

are connected by streets. People walking on the streets made the street a socializing space as well as a circulation space. And meanwhile, he made a definition on streets in the vehicle era: “Street is the linear space that has the coupling relationship with buildings, and it is the space that supports walking”. Thus, streets cannot isolate with buildings and the dynamic of streets will not last without pedestrians.

In China, many streets were widened in order to meet the needs of the development of cities. Therefore they serve mainly vehicles instead of pedestrians, which cause the loss of street life. Especially in city centers, although the wide roads meet the needs of traffic flow, they depressed diverse street life and street culture.

1.1.4 Separation between Pedestrian Systems and Buildings

Buildings, which limit spaces, have not contributed much for public space in China. Instead, they are separated with each other, to make the maximum profit for themselves. Therefore, buildings and traffic roads work together, narrowing down the pedestrian streets.

1.1.5 Needs for Complete Pedestrian Systems

On June 21, 2002, *Shanghai Traffic Report*[1] was published, which made pedestrian systems an important part of the traffic system. To be more specific, the solution included raising the standard of pedestrian streets, adding safety islands, and separating vehicles and pedestrians. The goal was to make Shanghai a walkable city.

In *Shanghai “Twelfth Five-year” Comprehensive Transportation Planning*[2], The goal of the Shanghai government was to establish a safe and green comprehensive transportation environment, which enhances the priority and accessibility of public transportation. Also, the planning mentions the protection of pedestrian space. The pedestrian system would be completed, in order to create a safe and desirable walking environment.

Nowadays the Pudong elevated pedestrian paths are under construction, which include Pearl Ring, Oriental Floating Court, Century Bridge and Century Corridor. Among them, all walkways have been put into use except Century Corridor (which will be finished by the end of 2013). On December 31, 2012, Shanghai Lujiazui underground development project started, in order to connect the underground space of Jinmao Tower, Shanghai World Financial Center and Shanghai Center (under construction). The project will be finished in 2014, at that time a comprehensive

[1] Shanghai City Traffic Paper, 2002/06, http://www.jt.sh.cn/infopub/xxgkml/ghjs/ghjh/info-0007.html.
[2] Shanghai comprehensive transportation development plan, 2012/03 http://www.sdpc.gov.cn/nyjt/fzgh/t20120723_493135.htm

multi-level pedestrian system will enhance the connection between buildings, separating vehicles and pedestrians, providing a desirable walking environment.

1.1.6 Research Significance

The redevelopment of cities centers and the planning of new cities all focus on the development of a pedestrian system. Current methods such as underground and elevated walkways are just passive measures. They do not integrate pedestrian, vehicular and building systems and therefore are not conducive to a city's street life. At best, these systems still leave pedestrian behavior intermittent and discontinuous, instead of streamlining the flow of people and goods.

Buildings are playing vital roles in urban public space, such as offering public space within buildings, supporting the function needed by the public, improving the environment of public space, and working as nodes to reconcile the contradiction between vehicles and pedestrians. In order to implement these roles, a symbiotic relationship between pedestrian systems and buildings is highly required. While currently in China, functions are highly concentrated in city centers and cities are developing towards a high-density way, which leads to the development of three-level traffic systems especially in city centers. In the process of weaving together new building and traffic infrastructure, China has a great opportunity to establish pedestrian systems that are integrated with buildings.

1.2 Related Concepts

1.2.1 City Center

City center is the core of public activities, with the feature of multi-function and high-density. It offers facilities and serving space for social activities, economy and political events.

1.2.2 Pedestrian System

It is a kind of traffic system which integrates diverse functional spaces, network of streets and environmental elements. "Walking path, public space and infrastructure make up the pedestrian system. (1)Walking path includes the corridor that connects multi-level pedestrian streets, and the corridors inside the building. (2)Public space includes the plaza, green space, socializing space inside the building, bus station,

parking, and the like. (3) Infrastructure includes signs, service facility, and similar."[1]

1.2.3 Symbiotic relationship

"A symbiotic relationship is one in which two organisms equally benefit from each other. An example of this type of relationship is the one between flowers and bees. The bees feed off the nectar of the flower. In turn, they transport pollen to other flowers."[2] In the symbiotic relationship between buildings and pedestrian systems, buildings work as nodes, reducing the confliction between vehicles and pedestrians. And buildings support the continuity of pedestrian behavior, and enhance the diverse of walking space. Thus, it improves the quality of walking space.

1.3 Literature Review

1.3.1 Study on High-Density Cities

With economic globalization, economic factors such as industry, information, energy, and manpower are showing a trend of aggregation, which enhances the rapid development of cities. The process inevitably stimulates the high-density development of cities. Many researchers propose such strategies and solutions for high-density cities.

Based on the urban characteristics and structures in China, Miao Pu put forward six design principles for the cities in high density environment ten years ago, which is still valuable nowadays.

Gao Rong and Yang Changming propose five strategies, in order to preserve public space in high-density area, with the knowledge of economy and urban planning.

Taking a compact city and its high density surroundings as precondition, Dong Chunfang discusses some relevant architectural practices, and explores the tactics and patterns to cope with the development of high density urban space in terms of the architectural substance, function, and space of the urban space left over by existing buildings and the spatial situation among those buildings.

Wang Zhendong and Chen Yi discuss ecological strategies of urban building complex layouts on four levels: encourage walking trips with regard to transportation, encourage diversified transportation ways to improve urban efficiency, create functional shares to boost coordination functions, and create place effects to build up

[1] Lei Shan. *Study on the multi-level pedestrian system*. Urban Planning symposium (2011)
[2] "What Is Symbiotic Relationship". http://www.ask.com/question/what-is-symbiotic-relationship

urban spirits in order to play a guiding role in design.

Li Jiali and Chen Hanyun focus on city update, indicating the shortage of urban renew in Hong Kong. They select main factors affecting urban planning and argue how they can boost the development of Hong Kong.

Tong Xin and Wang Xiaofan research the perceived density in Hong Kong and conclude the relevant factors which have direct influence on perceived density, in order to create desirable public space under high-density environment.

1.3.2 Study on Pedestrian Systems

Pedestrian systems can be divided into four models by altitude: sky-bridge system, ground level pedestrian system, underground pedestrian system and three-level pedestrian system.

Sky-bridge System

Altucker, K. mentions in *Downtown Skywalk Falls into Disfavor* that sky-bridge system is a kind of closed system that connects various shops, restaurants and offices.

Footbridge is the original style of a sky-bridge system in China. In order to solve traffic problems, the sky-bridge system was put into utilization. Wang Songtao and Zhu Yin propose the main points on sky-bridge system design in *From Sky-bridge System to Aerial Business Street*, and they raised an example of Chongqing Guanyin Street.

Ye Ming made an objective analysis of the formation and feasibility of the skywalk system in Hong Kong CBD. He firmly believes that the skywalk system is efficient in the areas with high-intensity development and heavy traffic, but it is not a solution to all circumstances; it is only appropriate under certain conditions.

The work of Dong Hexuan shows that urban three-dimensionalization refers to the three-dimensionalization of urban activities, which is an efficient way to support the operation of cities, under the condition of resources shortage.

Qin Jian states that based on the planned basic materials of Pudong Park of Shanghai world Expo, 4-phase model such as “travel creating-travel distribution-traffic mode division-traffic assigning” is mainly used. He illustrates the traffic demand of the elevated footpath in the park, reasonably selects the service level and traffic capability, and finally defines the construction scope of elevated footpath.

Underground Pedestrian System

In the background of accelerated urbanization and intensive land use, making full use of underground space is an efficient way to save land. And it can also contribute to low-carbon and sustainable development of China. Related articles: *Three-dimensional Development and Land Use in Urban Space, Development and*

Land Use of Underground Space, and so on.

Zhu Liangcheng, Lu Shan and Su Yu strongly argue that that we are facing the challenge of urban underground space development and utilization uncoordinated with rail transit construction. By analyzing the connotation and characteristics of TOD and referring its core concept, they suggest three features and four aspects of the urban underground space planning model based on TOD，and explore an effective way to solve the uncoordinated problem and promote the low carbon and sustainable urban development.

Wang Yueli and Liang Lignag observe that Pedway, which developed in 1951, is a huge underground walking system throughout Downtown Chicago. It not only provides a safe and desirable walking space by protecting pedestrians from bad weather and high-speed traffic in and around Downtown Chicago, but also acts as a linear connection of public and private buildings in Downtown Chicago and creates a multi-functional underground complex. The underground complex, named as “Subterranean City”, includes transportation, business, office and other functions. They introduce this successful system from its history, physical environment, planning system and policies.

Ground level Pedestrian System

Lu Ke and Pan Haixiao demonstrate the experiences and efforts improving urban pedestrian movement in UK, Germany and USA in recent hundred years, including “Radburn” in residential area, Buchanan’s report for traffic in urban environment, traffic calming and the most recently idea of street sharing developed in Australia.

While business streets are common ground pedestrian system, pedestrian systems that aim at commerce is a popular contemporary move and there are many examples of research on it, such as *Research on Pedestrian Environment in City Center, System Planning for Regional All-Weather Pedestrian Facilities: A Case Study of Golden Triangle Area in Luohu District, Shenzhen, To Establish Modern Pedestrian Streets with Country Context——Take Liuzhou as an Example,* and the like.

Three-level Pedestrian System

In the middle of the twentieth century, some developed countries started to do research on the renovation of the three-level city, meanwhile, pedestrian system gradually developed towards three-level system. Related articles: *To Establish a Three-dimensional and Efficient Pedestrian System — Take Hangzhou as an Example, Sustainable Pedestrian Environment — Research on the Design of Business Street,* and similar.

1.3.3 Study on the Relationship between Urban Public Space and

Buildings

Urban public space has been researched abroad significantly by professionals such as Kamino Kit, Kevin Lynch and Jane Jacobs. From the perspective of physical space: in the 19th century, Kamino Kit concluded art principles for urban construction from numerous cases, and finally published *The Art of Building Cities*. Later on, Frederick Gibberd studied the arrangement of architecture and space in terms of vision and aesthetics (*Town Design*). *Street and Square* written by Cliff Moughtin offers a detailed analysis of urban design, covering the streets, squares and buildings that make up the public face of towns and cities. It includes the arrangement, design and details of these elements and the roles they play in city planning. Gordon Cullen pioneers the concept of townscape in *The Concise Townscape*, he states that "Townscape" is the art of giving visual coherence and organization to the jumble of buildings, streets and space that make up the urban environment. His theory has been a major influence on architects, planners and others concerned with what cities should look like. In *Exterior Design in Architecture*, Ashihara Yoshinobu emphasizes the design method of exterior space. Other famous books in the field of urban planning, such as *Collage City* (Colin Rowe) and *The Architecture of the City* (Aldo Rossi), propose comprehensive theories about physical space.

From the perspective of people's activities: *Image of the City*, written by Kevin Lynch, is regarded as the most important postwar book written about urban design. He discusses the image of cities through the cognition of residents, which creates a new research method based on observation. Jane Jacobs criticized the theory of urban planning we historically applied, and proposed new principles by observing ordinary scenes and activities during real daily life. In *The Death and Life of Great American Cities*, she puts emphasis on the importance of streets which work as a vital public place in the city. In the 1970s, some research reports about squares on the east and west coasts of America were published, which were included in *Society Life in Town*. Jan Gehl's *Life between Buildings: Using Public Space* described essential elements that contributed to people's enjoyment of spaces within the public realm. These elements remained remarkably constant, even as architectural styles go in and out of fashion, and the character of the "life between buildings" changes. In *People Places: Design Guidelines for Urban Open Space*, Clare Cooper Marcus and Carolyn Francis discussed seven types of urban open space: urban plazas, neighborhood parks, miniparks and vest-pocket parks, campus outdoor spaces, outdoor spaces in housing for the elderly, child-care outdoor spaces, and hospital outdoor spaces. They focused on the outdoor space which plays an important role in people's daily life. All of the researchers put emphasis on people above anything else, as they shape the public

space in cities.

Shared space is an urban design approach which seeks to minimize demarcations between vehicle traffic and pedestrians, often by removing features such as road surface markings, traffic signs and regulations. Typically used on narrower streets within the urban core and as part of living streets within residential areas, the approach has also been applied to busier roads. Prior to the adoption of the term, street design projects carried out in Chambéry (France) by Michel Deronzier from the 1980 used the term “pedestrian priority”. The term was used by Tim Pharoah to describe informal street layouts with no traffic demarcation (for example *Traffic Calming Guidelines*, Devon County Council, 1991). It was more widely applied, especially by Ben Hamilton-Baillie, since the preparation of a European co-operation project in 2003. The European Shared Space project developed new policies and methods for the design of public spaces with streets between 2004 and 2008 under the leadership of Hans Monderman until his death in 2008.

The theory of public space in buildings was proposed by John C. Portman, Jr., an American architect and real estate developer widely known for popularizing hotels and office buildings with multi-storied interior atria, when he introduced modern atrium into hotel buildings. With the development of public space in buildings, it has been a type of space being widely used in hotels, commercial buildings, office buildings, educational buildings nowadays, which transforms a lot from what it used to be.

There is also a great deal of research about public space in China. Zhu Xiaojun gives a profound new take on public space. He asserts that many designers pursue strong visual effect in urban public space such as big lawn, huge-scale squares, rather than taking human being’s activities into consideration.

Du Jia and Hu Zhengyan expatiate the principles of New Urbanism, such as encouraging walking, mixing function, and then propose some strategies for Chinese urban public space.

Wang Rong and Hu Wangshe classify the complex's public space into three types. Afterwards, they analyze the active space by studying successful examples and sum up the intrinsic factors which stimulate vitality.

The accessibility of open space bases on the connectivity of path network, meanwhile, the favorable environment is the main factor to encourage pedestrian behavior. Dong Yu proposes several ways to complete pedestrian network as well as to enhance environment quality, in order to create urban open space which is good for pedestrians.

In view of the historic evolution of pedestrian space, Qiu Shujjie explores the quality of social association and public life on street, creating an analysis of the

characteristics of urban block neighborhoods on structure, form, scale and change. He expatiates successful experience of walking street design at home and abroad, and points out that landscape street, which plays an important role in the recovery of historic civic centers, can improve inhabitants' lives as well as promote commercial culture.

Wang Yongfan discusses the relationships between urban public space and architecture through three aspects: architecture's effect on urban public space, city orientation factors which affect architecture and the way buildings shape public space, in order to enrich the content of urban public space.

Research shows that urban spatial structure has a lock in effect on CO_2 emission and sustainable urban development; most cities in China are currently undergoing spatial restructuring, learning how to plan a more sustainable spatial structure is worthy of study. In Spatial Planning Strategy for "Low Carbon Cities" in China, Pan Haixiao and Tang Yang analyze the methodology of urban planning formulation at the regional, city and street block level, and several arguments on urban land use, transport, density control and mixture of land use have been discussed towards low carbon urban spatial strategy.

Sun Tongyu believes that a region is a concentrated expression of urban culture, while the urban public space is the stage of urban culture. And the architecture in the city builds the urban public space. At the same time, urban public space has become the soil of the expression of regional architecture. The good relationship between the architecture and urban public space not only meets the request of a varied regional urban life, it can further inspire the passions and creativity of the citizens to make more vitality in urban life. The characters of urban life create the urban culture; urban culture creates the regional architecture and city. And the architecture plays an important catalytic role in the process.

Liao Fang explores the creation of urban public spaces in architectural design from the perspectives of the exterior order optimization and opening up of architectural space.

Public Space in Hong Kong is classified into waterfront, business, transport node and neighborhood type by Xu Ning and Xu Xiaodon. They analyze these four types and sum up the feature of public space in Hong Kong, in order to provide ideas to mainland urban public space design. Wang Suyi studies the organization of transportation and public space around the urban complex, by taking He Fei Wanda Square as an example. He demonstrates the effect on public space caused by transportation.

1.3.4 Study on the Relationship between Pedestrian Systems and

Buildings in Hong Kong, Bangkok and Boston

Hong Kong has developed an efficient urban pedestrian system, which provides successful precedents for high-density cities. Fei Yishan and Wang Jianguo review the development process of urban form and transportation in Hong Kong, and conclude that the harmonious relationship between urban form and transportation is prerequisite to a dynamic city.

The pedestrian system in Hong Kong Central is a network, which is a common outcome of the city evolution in terms of quick development and topography conditions. By learning from the successes and failures of its pedestrian system, Guo Wei and Hou Xiaolei propose that pedestrian systems of high-density urban center areas should adopt the following strategies: Establish a level-network structure of pedestrian systems; Construct a composite pedestrian system with high-connectivity; Advocate multi-functional use of pedestrian system space; Set and utilize the pedestrian system nodes in reason. They believe that these strategies will serve as an effective reference for other similar construction of high-density urban centers to construct an economic and efficient pedestrian system.

Chen Keshi and Cui Chong introduce Causeway Bay CRD (Central Retail District) and Victoria Park in detail. They believe this urban core with less than one square area, which was derived from the concept of British Garden City and adapted with the Chinese Communities, will become the successful model of spatial design in urban centre districts, and guide the direction of urban development with Asia's crowded cultural background in China.

The city center of Bangkok has high density, and what is more, as a famous tourism city, a large number of tourists greatly increase the traffic load. But the elevated walkway in Pathum Wan successfully solved the problem of the confliction between vehicles and pedestrians. The elevated walkway is connected by buildings, providing a safe and desirable walking environment, which is highly popular among the public. Related reference: *Built environment and pedestrian behavior at rail rapid transit stations in Bangkok; 'Super Skywalk' to end Bangkok's pedestrian Nightmare； The Skywalk in Bangkok；Improving Conditions for Pedestrians in Bangkok；BMA's Super Skywalk will make Bangkok pedestrian friendly*.

The sky bridges in Boston connect numerous building in downtown area, which provides great convenience for pedestrians. But the nice elevated pedestrian system causes the fading of street life in that area.

1.4 Research Content and Methodology

1.4.1 Research Content

Most studies neglect the role that buildings are playing in pedestrian systems. Therefore my study will focus on the relationship between buildings and pedestrian systems.

The main research work of the paper is listed below: (figure 1.5)

(1) With the analysis of the successful pedestrian systems of Hong Kong, Bangkok and Boston, I summarized a variety of connection methods between buildings and pedestrian systems, as well as several ways that multi-function buildings can support pedestrian systems. After that the Assessment Methodology was proposed in terms of the three precedents together with related theories.

(2) By implementing the Assessment Methodology on three city centers in Shanghai (Wujiaochang, Yangpu District, Lujiazui, Pudong District and Xujiahui, Xuhui District), I summarized the merits and demerits of each city center.

(3) I proposed the design strategy on the symbiotic relationship between pedestrian systems and buildings on the basis of former analysis of Hong Kong, Bangkok and Boston, together with the three city centers in Shanghai.

(4) Basing on the design strategy, I proposed a design for one site within Wujiaochang, in order to create a convenient, desirable and dynamic place for pedestrians, as well as solve the existing problems of pedestrian systems in the entire area.

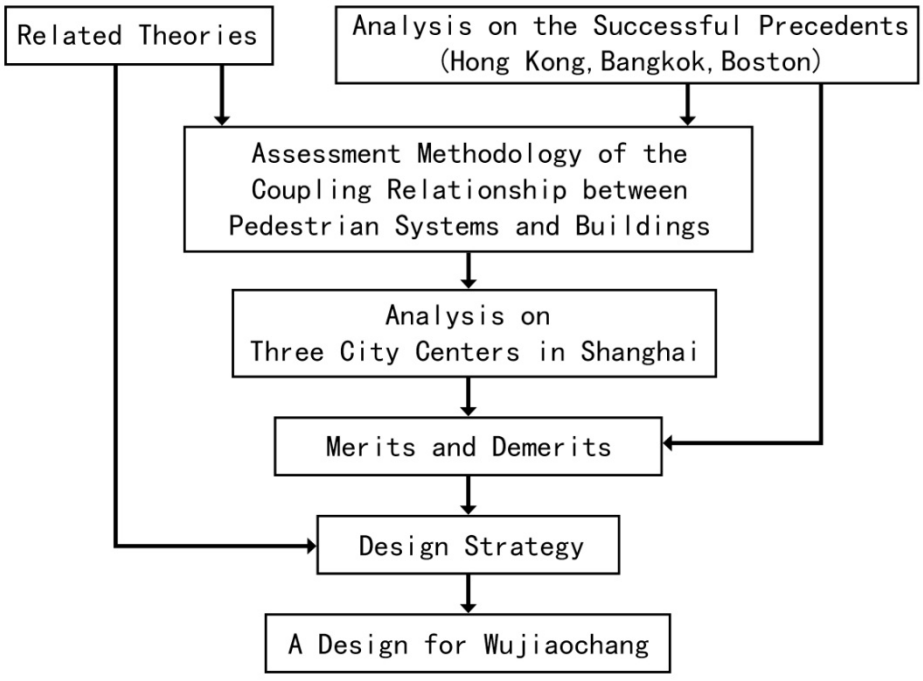


Figure 1.5

1.4.2 Research Goals

Hopefully the outcome of my thesis would be implemented into a real project, taking full use of buildings in pedestrian systems, in order to enhance the efficiency and comfort level for pedestrian, stimulate more socializing and activities in public space, and therefore will improve the street culture. Meanwhile the complete pedestrian systems in city centers would affect the surrounding area, leading to the construction of pedestrian systems in the entire area.

1.4.3 Research Methodology

(1) Interpretive-Historical

A profound understanding of the developmental process of pedestrian system, public space in China and abroad is vital to the project. Meanwhile, it will certainly include the history, development pattern, economic system and culture of a country, which can help me grasp the factor of contemporary pedestrian systems in depth.

(2) Site Research

In this phase, I will select pedestrian systems of three Shanghai urban cores — Lujiazui in Pudong New Area, Xujiahui in Xuhui District, and Wujiaochang in Yangpu District as my research objects. By observing the relationship between buildings and pedestrian systems in these sites, I could get first hand information in order to make more objective evaluation on the sites.

(3) Behavior Observation

By observing the users, noting their behavior and reactions to the built environment, I could understand their needs and suggestions about the pedestrian systems. Thus the design strategy could be generated.

Chapter 2 Analysis of Successful Precedents

Hong Kong Central elevated pedestrian system is one of the most successful examples in China, therefore a lot of research material is available. And I stayed in Bangkok for 10 days, in Boston for almost 2 months, did a careful study on their elevated pedestrian system. Hence, I selected Hong Kong, Bangkok and Boston as my case studies, to analyze their successful design methods.

2.1 The Study of the Symbiotic Relationship between Pedestrian Systems and Buildings in Hong Kong

Hong Kong is located on the south coast of China (figure 2.1). The density of Hong Kong increases every year, and reached 6464/square kilometer in 2012[1]. Hong Kong is the third biggest financial centre after New York City and London.

Hong Kong Central is the heartland and the first developed area of Hong Kong (figure 2.2). Numerous banks, office buildings, restaurants, embassies, flagship stores make Central the most popular area among residents and tourists of Hong Kong.

Figure 2.1

Figure 2.2

2.1.1 Background

In the early development, the design of streets was based on vehicle movements, with pedestrians as the secondary focus. Therefore numerous problems appeared in walking space. With the development of society in the city, the importance of a healthy walking environment is gradually rising.

[1] http://news.xinhuanet.com/gangao/2012-08/13/c_112712797.htm. Last modified: 2012/08/13

Nowadays, numerous elevated walkways are set up in crowded areas (figure 2.3), which fully considered about the pedestrian circulation, effect on roads and people's needs. The comprehensive walking network can completely reduce the conflict between pedestrians and vehicles, increasing the efficiency and accessibility.

Figure 2.3

The Hong Kong government published Hong Kong Pedestrian Planning[1], which makes walking area the most important public space. The four principles are listed below:

(1) Connection: there should be clear traffic signs in the path and the accessibility facilities are important, such as escalator, elevator.

(2) Safety: separate pedestrians and vehicles

(3) Comfortable: walkways should extend in all directions, with complete shading devices.

(4) Attraction: each pedestrian system should have its own characteristic, and could have facilities to support activities, such as performances, farmers' markets.

2.1.2 Construction Process of Pedestrian System in Central

Numerous elevated walkways were built in the 1970s. After the 1980s, an elevated walking network was gradually formed, connecting main buildings as well as the dock and bus stops, forming a 3km long elevated pedestrian system[2].

2.1.3 Symbiotic Relationship between Pedestrian Systems and Buildings in Central

The pedestrian system includes walkways at ground, elevated and underground level, forming a complete multi-level pedestrian system. Among them, the elevated walkway is the most successful one. The elevated pedestrian system and buildings formed a big walking network, which provides a safe, convenient and desirable walking environment.

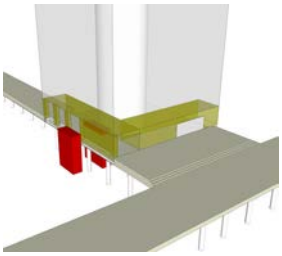


Figure 2.5

There are a variety of ways that buildings and pedestrian

[1] The pedestrian environment planning of Hong Kong (2002).

[2] Peng Qingyan. *Construction and Applicability of Elevated Pedestrian Facilities.* Urban Transport of China, 2011(11)

systems integrating with each other. I have summarized 6 ways below (figure 2.4):

(1) Elevated plaza connects buildings and walkway (Exchange Square, figure 2.5)

The walkway which is parallel with the entrance of the building is connected with the building by a plaza. The plaza works a transition space as well as a bigger node to release the intersection of pedestrian flow, as well as offering people a relaxing platform. There are three office buildings in Exchange Square, all of them are connected by elevated walkways, which creates a changeable space and landscape in elevated pedestrian system.

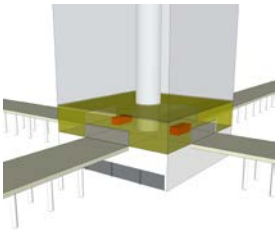


Figure 2.6

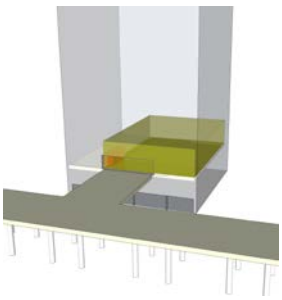


Figure 2.7

(2) Walkways Pierce through the Building (International Financial Center, figure 2.6)

The second floor is fully open to the pedestrian system. Hence, several walkways are intersecting inside the building, integrating with building space. What is more, there are escalators along the walkways inside the building connecting with first floor, which connects ground and elevated level pedestrian systems. Therefore the building becomes an essential part of pedestrian system.

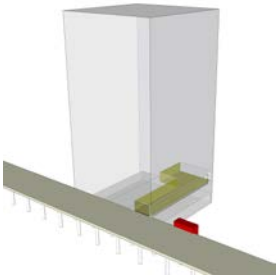


Figure 2.8

(3) A short corridor connects building and walkway (Jardine House, figure 2.7)

The building works as the node on the bench of the main walkway. It shows a parallel connection with pedestrian system. The openness is far more less than (2), and the relationship between buildings and pedestrian system is not as close as (1) and (2).

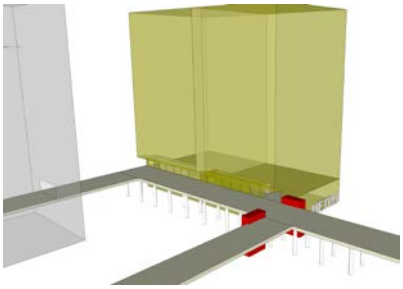


Figure 2.9

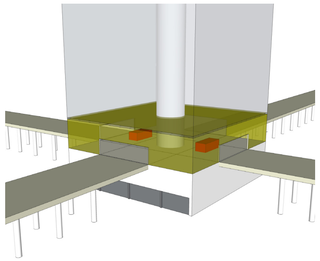
(4) One branch of the walkway intersects the building (General Post Office, figure 2.8)

Two sides of the building are surrounded by walkways, one of them belongs to the building while the other one belongs to pedestrian system. At the end of the walkway inside the building, there is a big public space. Thus, the building and walkway fuse with each other.

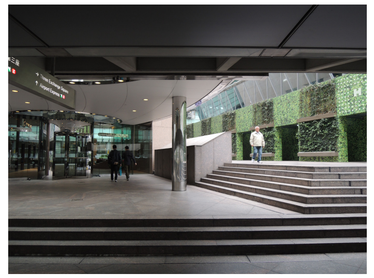
(5) Small shops interconnect buildings and walkway (World Wide House, figure 2.9)

International Financial Center
(Interior)

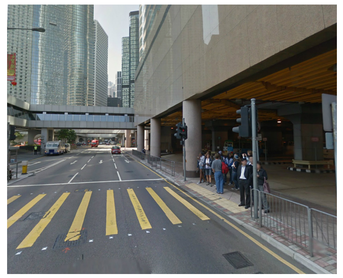
International Financial Center
(Exterior)



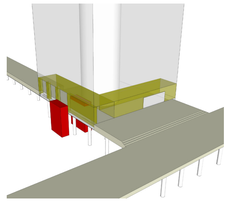
Walkways
Pierce through
the Building



Exchange Square (Interior)



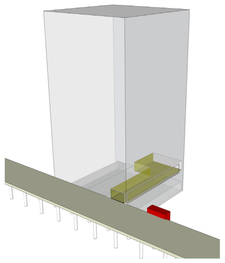
Exchange Square (Exterior)



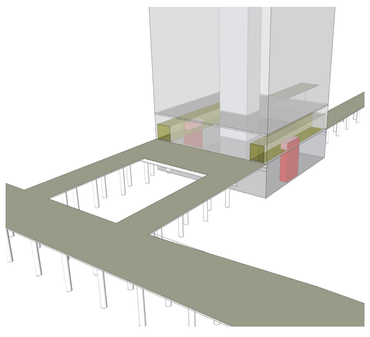
Elevated Plaza
Connects Building
and Walkway

General Post Office (Interior)

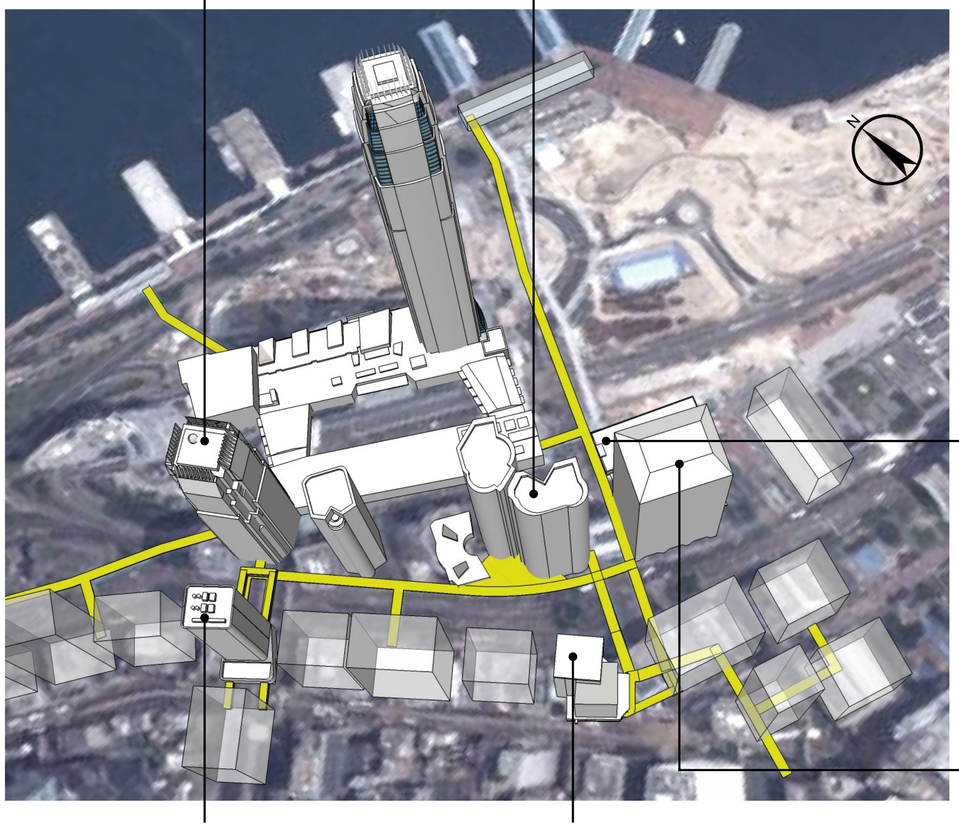
General Post Office (Exterior)



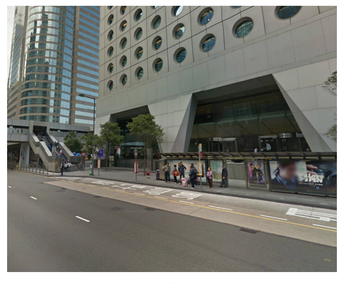
One Branch of the
Walkway Intersects
the Building



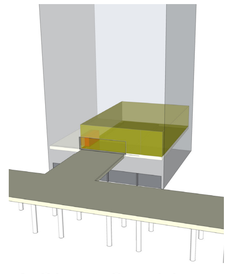
Open Atriums / Gardens
Connect Building and Walkway



Jardine House (Interior)



Jardine House (Exterior)

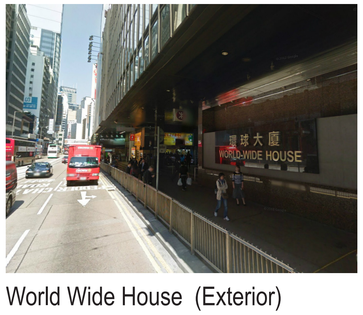


A Short Corridor
Connects Building
and Walkway

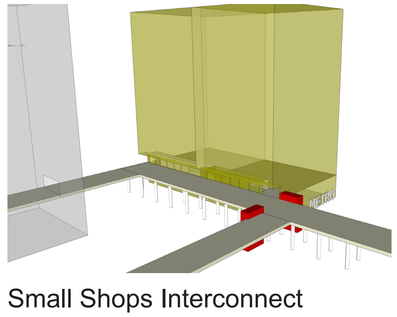
Hang Seng Bank (Interior)

Hang Seng Bank (Exterior)

World Wide House (Interior)



World Wide House (Exterior)



Small Shops Interconnect
Building and Walkway

Public Space

Escalator / Stairs
to the Ground

Figure2.4 Connection Methods between Buildings and Pedestrian Systems

The edge of the building are filled with various shops, such as noodle shops, café, bookstore, retail, which greatly reduce a sense of the boundary of the building. The building provides functional support for the walkway, which makes the walkway not only for circulation, but also for entertainment and dining.

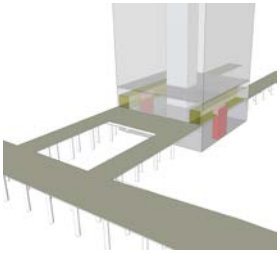


Figure 2.10

(6) Open atriums / gardens connect building and walkway (Hang Seng Bank, figure 2.10)

This is the evolution of (1), adding atrium or garden in the elevated plaza. It offers a better relaxing / socializing space. An Open atrium connects Hang Seng Bank and the pedestrian system, which reduces the negative effect above the road as well as increases the visual connection.

Figure 2.11

The accessibility facilities are important in Central, since the elevated level is the main circulation. Therefore, many walkways integrate with ramps, which greatly benefits handicapped and shopper. (Figure 2.11)

Figure 2.12

Besides, Hong Kong belongs to subtropical monsoon climate[1], has one of the heaviest rainfall in China. And during summer, intense sunlight happens frequently. Therefore the shading devices are essential. The shading devices offer full protection for pedestrians, creating a desirable walking environment. And the plants along the walkways increase the comfort level of Central. (Figure 2.12)

As for the relationship between buildings and ground level walkways, most buildings are unenclosed at the ground level, open to the public. I summarized 3 ways below:

(1) The ground floor is completely unenclosed (Exchange Square, figure 2.13, 2.14)

The unenclosed ground level is fully integrated with

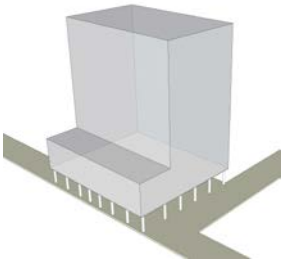


Figure 2.13

Figure 2.14

[1] "Climate of Hong Kong". http://www.hko.gov.hk/cis/climahk_c.htm.

walkways. The open floor is an ideal place to hold public activities.

(2) A portion of the ground floor which goes along the walkway is elevated (General Post Office, figure 2.15, 2.16)

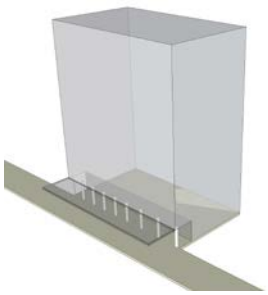


Figure 2.15

Figure 2.16

First floor of the building sets back from the sidewalk, forming an intermediate space between exterior and interior. The space creates the opportunity for people to stop and socializing, therefore creates more business for the shops on the ground level. Meanwhile the cantilevered part provides shading for pedestrians.

(3) Building extends above the walkway (World Wide House, figure 2.17, 2.18)

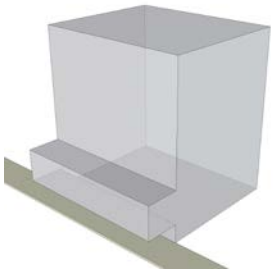


Figure 2.17

Figure 2.18

Second and third floor of the building set above the sidewalk, which directly shade the sidewalk. And what is more, there are numerous shops along the edge of the building, fully support walking behavior. The space above the sidewalk belongs to the pedestrian system as well as the building, reducing the boundary of the building, fusing building space and walking space. And also, the space connects with a metro station.

Figure 2.19

What is more, numerous bus stops sit in the unenclosed ground level of buildings[1] (figure 2.19), which provide a desirable waiting space. And some metro stations connect with underground level of buildings, which makes buildings as essential vertical transit nodes. The importance of buildings is fully expressed in Central.

[1] Zhou Yixin. *Comparison between Hong Kong Central and Arcade Buildings*. City, 2010(03).

2.1.4 Conclusion

(1) In Hong Kong, the pedestrian system and buildings are integrated into a big multi-level system. Buildings work as nodes, connect each part of the pedestrian path, therefore strongly support the continuity of walking behavior.

(2) Buildings integrate with pedestrian system in a variety of ways:

Elevated Level—

a. Elevated plaza connects building and walkway (figure 2.5)

b. Walkways pierce through the building (figure 2.6)

c. A short corridor connects building and walkway (figure 2.7)

d. One branch of the walkway intersects the building (figure 2.8)

e. Small shops interconnect building and walkway (figure 2.9)

f. Open atriums / gardens connect building and walkway (figure 2.10)

Gould Level—

a. The ground floor is completely unenclosed (figure 2.13, 2.14)

b. A portion of the ground floor which goes along the walkway is elevated (figure 2.15, 2.16)

c. Building extends above the walkway (figure 2.17, 2.18)

The integration of buildings with walkways shows the openness of buildings, meanwhile the special design at the border of buildings and walkways enhance the relationship between two different kinds of spaces. Thus buildings become an essential part in pedestrian systems.

(3) In central area, numerous bus stops sit in the ground floor of buildings (where part of the ground floor is unenclosed) (figure 2.19). Also, metro stations integrate with the first level below grade. Therefore buildings work as nodes that connect pedestrian systems on underground level, ground level and elevated level, contributing greatly to pedestrian. What is more, various shops along the border of buildings and walkways provide diverse function to the space, which support walking behavior greatly. (Figure 2. 9)

(4) Perfect ramps, accessibility facilities, shade design and green space increase the comfort level of walking space.

(5) The integration of buildings with pedestrian systems cannot be achieved without the support of the government. Numerous policies are adopted by Hong Kong government to encourage the connection between buildings and walkways. For example plot ratio reward, exchange function of the building, and the like[1]. The connection between buildings and walkways not only benefit pedestrians, but bring more people to buildings, which increase the profit of buildings. The win-win policy

[1] Lei Shan. *Study on the multi-level pedestrian system*. Urban Planning symposium (2011)

is a great strategy that other cities could learn from.

With perfect elevated pedestrian system, the pedestrian system at the ground level also received high attention by the government. The owner of the building would be award extra plot ratio if he is willing to provide unenclosed floor area at the ground level as public space.[1] This kind of policy is popular among the owners, and they set up retail shops and infrastructure to support pedestrian systems. Thus there is a great deal of walking space with high quality, in spite of the background of high density. And buildings are integrated with pedestrian systems, contributing greatly to walking behavior.

[1] Xu Ning, Xu Xiaodong. *Reading Urban Public Space in Hong Kong*. Modern Urban Research, 2012(2).

2.2 The Study of the Symbiotic Relationship between Pedestrian Systems and Buildings in Bangkok

Bangkok is the capital of Thailand, as well as the biggest city of Thailand. It is the economic, educational, transportation and culture center, with the density of 6247/ square kilometer in 2010.[1]

Figure 2.20

The elevated pedestrian system (Skywalk) locates in Pathum Wan, which is the center part of Bangkok (figure 2.20). Numerous shopping malls and markets are connected by a 1500-meter Skywalk, forming a huge elevated pedestrian system. And what is more, the Skywalk connects three stations of BTS Skytrain, which are National Stadium, Siam and Chit Lom (figure 2.21). Such a safe and convenient walking environment attracts a great deal of local people and tourists.

It it reported that the Bangkok government is planning a 50,000m Super Skywalk project[2], in order to provide bigger pedestrian system, and reduce the dependency on private cars. Thus, the traffic condition and air quality would be improved.

2.2.1 Background

Walking experience at the ground level is not good in the center of Bangkok. For example, sidewalks are always appropriated by vendors, some sidewalks become parking for motorcycle. Besides congestion, the quality of the sidewalk is poor, exemplified by uneven paving or small holes filled with water.

Therefore, in order to improve walking environment, encouraging more pedestrian

[1] "Population of Bangkok (2010)". http://worldpopulationreview.com/countries/thailand-population/.

[2] "Improving Conditions for Pedestrians in Bangkok" http://www.sutp.org/index.php/component/phocadownload/category/139-sd-cs?download=436:m-king-9up

activities, Bangkok Transit System Corporation started building Skywalk under the BTS Skytrain.[1] Later, the extension of Skywalk connects several Skytrain stations and shopping malls, which are popular among locals and tourists.

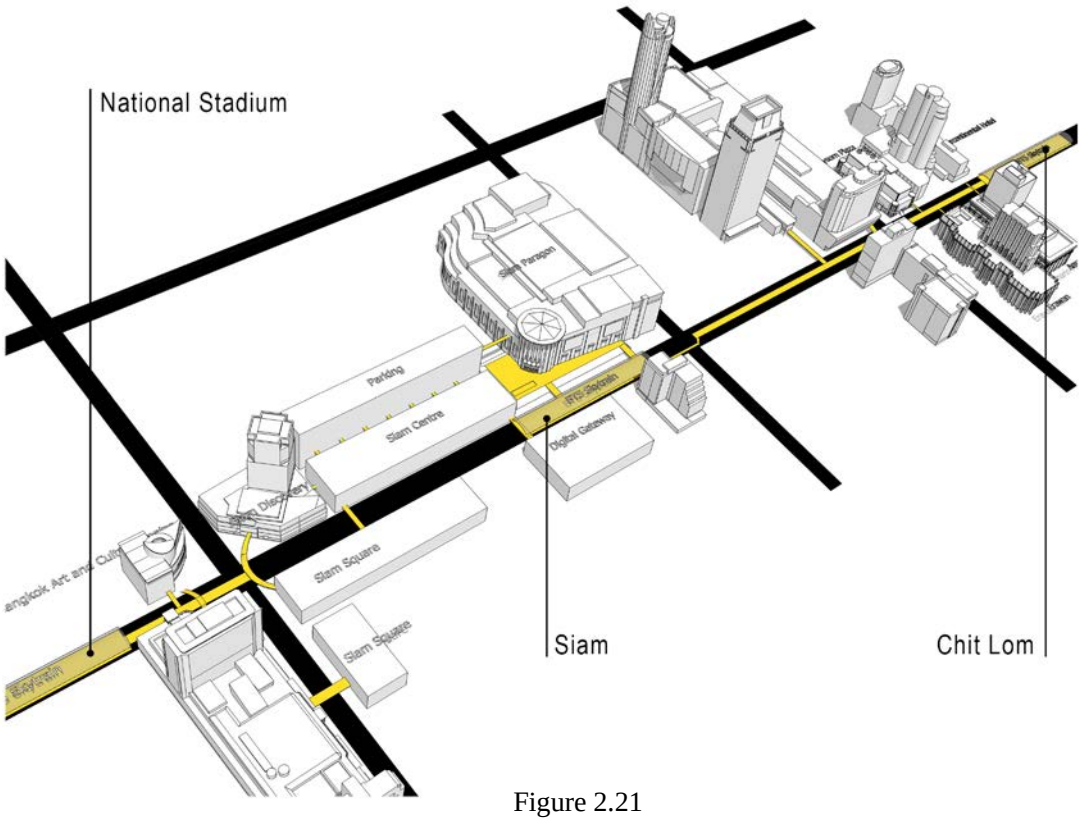


Figure 2.21

2.2.2 Influence

Most Skywalk is under the track of BTS Skytrain, therefore it is shaded by the track. And other Skywalk has shading devices. Hence, people can freely walk on Skywalk without worried about the weather. We can see from chart 2.1 that the walking distance around Chitlom station, the one with complete Skywalk, is much longer than other stations. And the continued Skywalk crosses through shopping malls, bringing huge profits to shop owners.

Station	Total Average Walk (m)
Chitlom BTS（with complete Skywalk）	305
Phrom Phong BTS	237
Lat Phrao MRT	206
Petchaburi MRT	247

Chart 2.1 Built environment and pedestrian behavior at rail rapid transit stations in Bangkok

[1] Craig Townsend,John Zacharias. *Built environment and pedestrian behavior at rail rapid transit stations in Bangkok.* Springer Science + Business Media, LLC. 2009

Nowadays, many people who do not need to take the Skytrain or shopping are all willing to walk on Skywalk, to enjoy wonderful walking experience. What is more, the comfortable walkway stimulates various activities. When night falls, youngsters always practice dancing on the Skywalk, which bring boundless energy for the area. And people always watching the shows performed on the ground level from Skywalk.

2.2.3 Symbiotic Relationship between Pedestrian Systems and Buildings

One of the biggest features of the Skywalk is that buildings along the Skywalk work as nodes in terms of connecting each part of the walkways, which greatly support the continuity and diversity of pedestrian behavior. We can see from figure 2.22 that pedestrians have many choices within the 1500m Skywalk, which are supported by buildings.

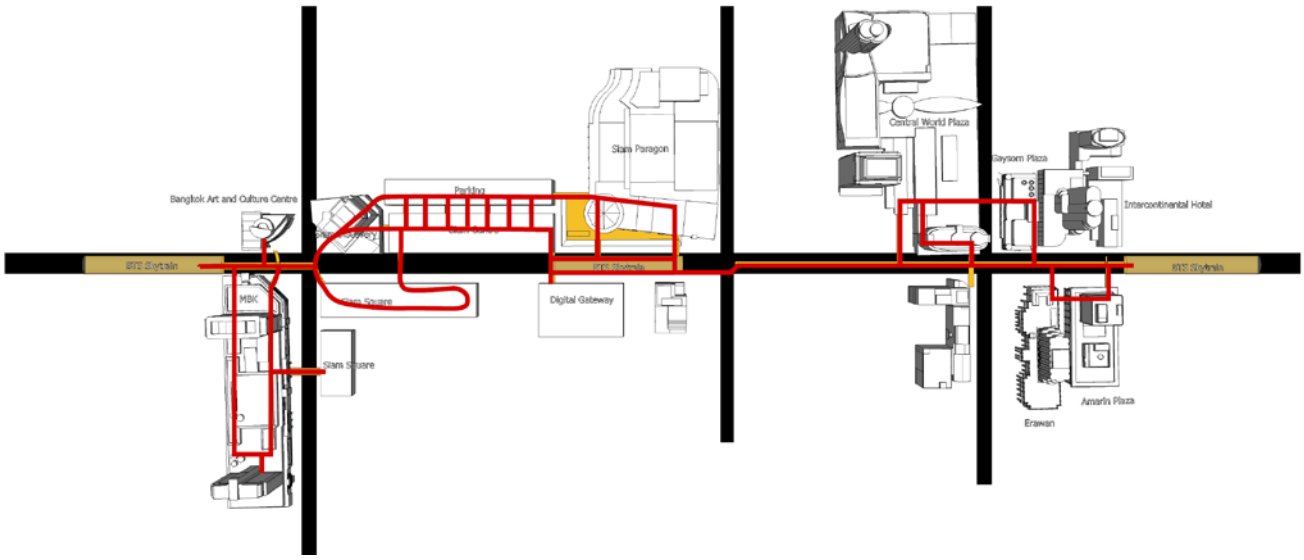


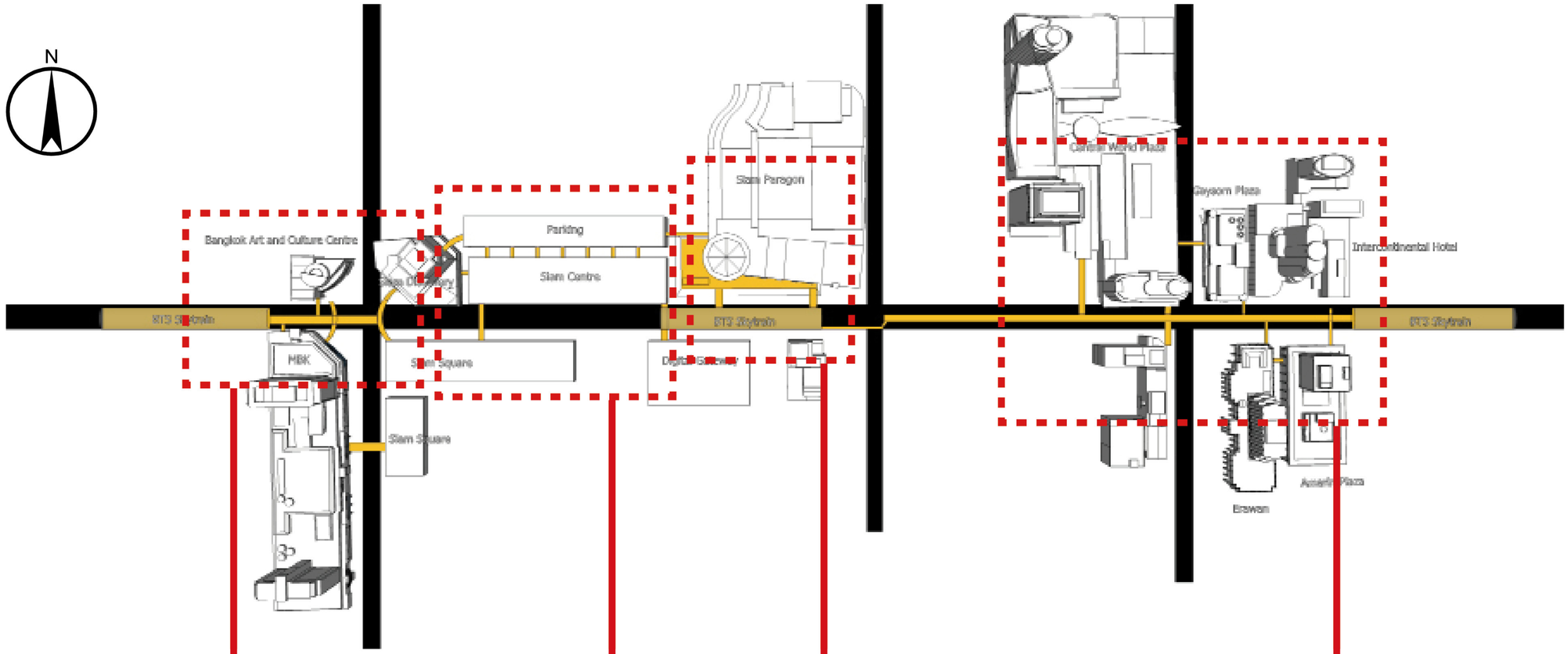
Figure 2.22

In the elevated pedestrian system, Skywalk connects with buildings in a variety of ways. I divided my study area into 4 regions (figure 2.23).

(1) Region 1: from the National Stadium station to Siam Discovery (figure 2.35)

At the west point of Skywalk, it connects with the terminal station (National Stadium) of BTS (figure 2.24). The width of the walkway is wide enough for huge amount of people. And the track of BTS offers enough shade for the walkway.

Figure 2.24



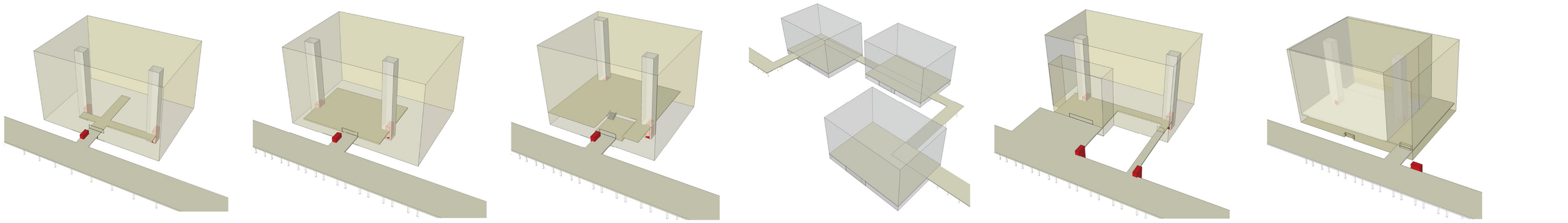


Figure2.23 Connection Methods between Buildings and Pedestrian Systems

Then, two branches of Skywalk connect with the second and third floor of MBK, which is landmark of Bangkok as well as the biggest shopping mall in Asia in old times (figure 2.25). The connection area between the second floor of MBK and Skywalk are a big interior space, which sells clothes (figure 2.26). The connection area between the third floor of MBK and Skywalk connects with the intersection of two interior corridors, offering alternative option for customers. Numerous signs pointing to Skytrain are hanging inside MBK, which makes it easier for people to find their way (figure 2.27). What is more, there is a path connecting the second floor of MBK with a hotel on the south side of MBK, which benefits the customers living in hotels.

Figure 2.25

Figure 2.26

Figure 2.27

Another branch of the Skytrain goes into an Art Museum on the opposite of MBK (figure 2.28). Because of the height difference, there is a small transition space inside the museum which is a half level below its second floor. Therefore, visitors go into the transitional space and then up to the second floor through the escalator or elevator. This path directly connects with the display corridor, which contributes most to visitors.

Figure 2.28

Towards east, the clean wide Skywalk is the main circulation during daytime, and also, it is the platform used to view the city (figure 2.29); during the night, the Skywalk become the stage for youngsters, showing the dynamic and fashionable side of Bangkok (figure 2.30).

Figure 2.29

Figure 2.30

Figure 2.31

The Skywalk crosses through the intersection, leading people into the third floor of a shopping mall called Siam Discovery (figure 2.31). And it connects with the intersection of three corridors inside the building, offering more choices for people.

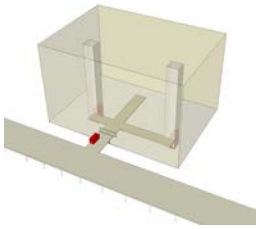


Figure 2.32

In Region one (figure 2.35), Skywalk and buildings show a parallel connection. Since the space limitation exterior, Skywalk and buildings are connected by one walking path. But inside buildings, the connection space are quite diverse. I summarize three ways below:

a. Skywalk connects with interior corridors (figure 2.32)

Although normally the connection area between Skywalk and buildings are not the main entrance of the buildings, the designers still put emphasis on the design of these connection nodes. The connection nodes are put at the intersection of several corridors inside buildings, successfully separate the crowd flow.

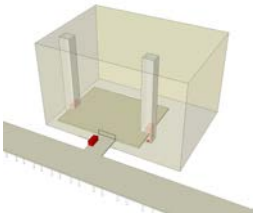


Figure 2.33

b. Skywalk connects with interior open space (figure 2.33)

The crowd is relieved from the Skywalk into larger open interior space.

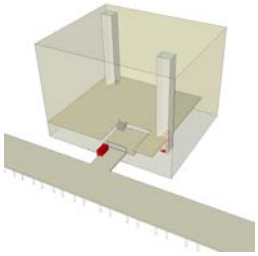


Figure 2.34

c. Skywalk connects with interior platform (figure 2.34)

The platform works as a small lobby, which is a great transition space between exterior and interior. This kind of space is important to Art Museum in terms of filtrating noise outside.

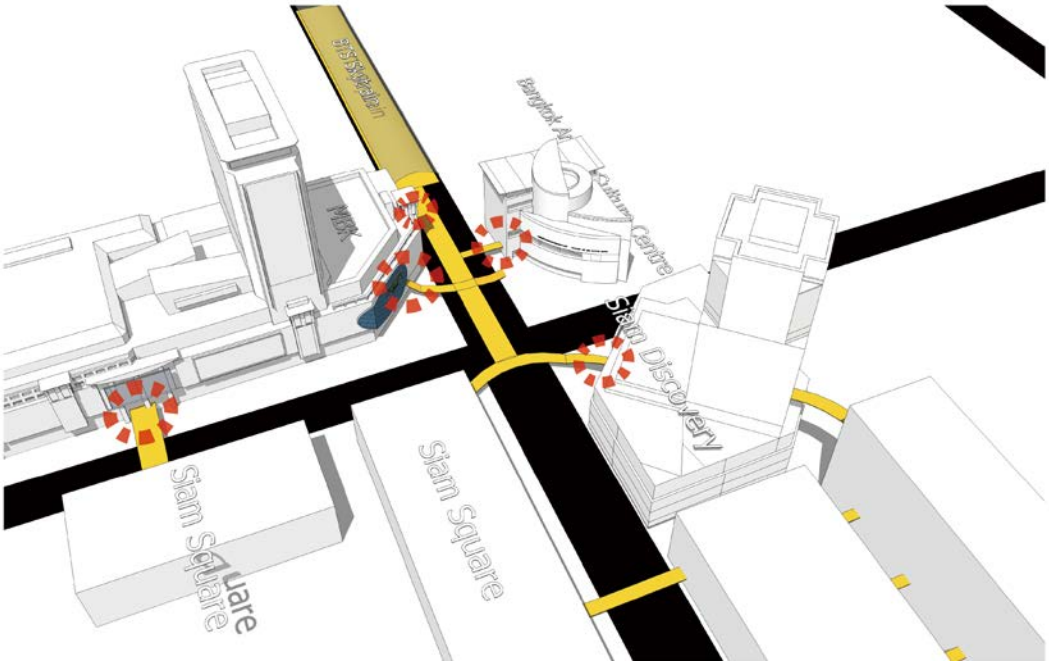


Figure 2.35

(2) Region 2: from Siam Discovery to Siam Center (figure 2.38)

Crossing through interior space of Siam Discovery, people will enter Siam Center on its east through a short corridor. And what is more, Siam Center and Siam Square (which is on the south of Siam Center) are connected by an elevated corridor, which is also the only way to cross the traffic road (figure2.36).

Figure 2.36

In this region, Skywalk and buildings (Siam Discovery, Siam Centre, Siam Square) show a series of connections. Buildings connect each part of Skywalk (figure 2.37, 2.38). Interior space of buildings and walking space integrate with each other, which enhances the walking experience. Besides, the functions inside buildings also serve for pedestrians, such as benches, tables. The importance of buildings is fully expressed in this region.

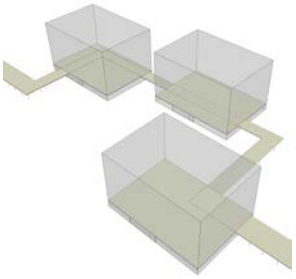


Figure 2.37

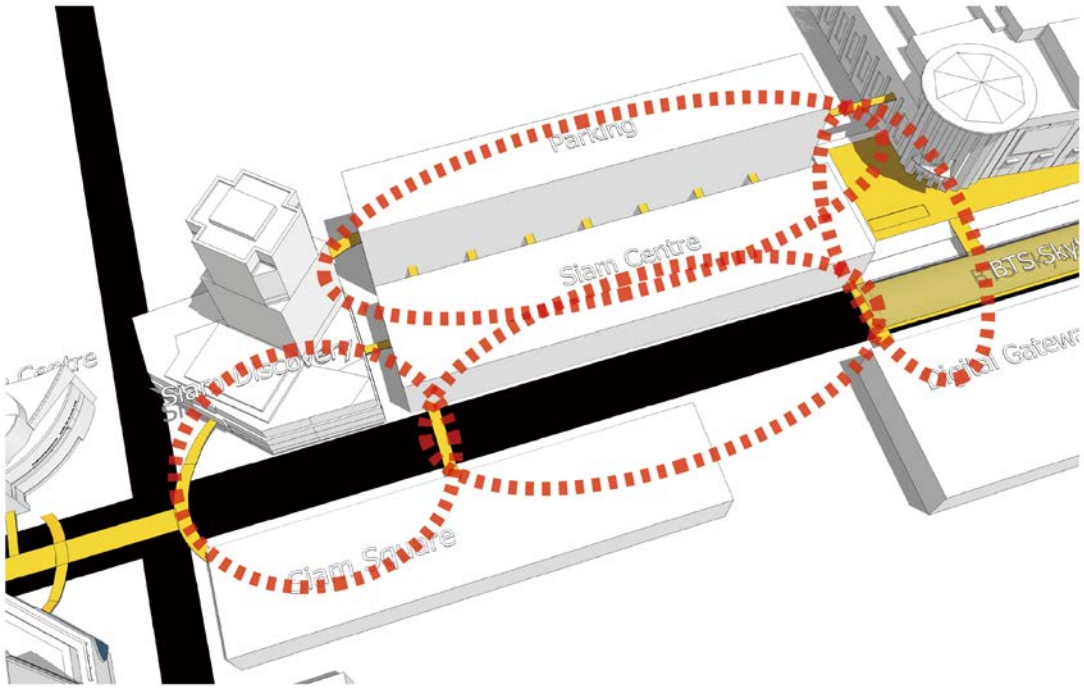


Figure 2.38

(3) Region 3: from Siam Center to Siam station of BTS (figure 2.48)

Siam station of BTS connects Siam Center, Digital Gateway and Siam Paragon on both sides of the traffic road (figure 2.48). There is a semi-outdoor space between Digital Gateway and the station (figure 2.39). After entering Digital Gateway, a big lobby leads to five corridors, including 2 escalators connecting with first and upper floor. The station and Siam Paragon are connected by an open platform, with fountain,

green space and benches (figure 2.40). And a stage and bleachers are also set on the platform, but few people stop by because of the lack of shading devices.

Figure 2.39

Figure 2.40

However, the situation is totally different inside the Siam Paragon. The three-floor height lobby attracts numerous people. And the landscape, light space, enough benches and temperature provide a great interior public space (figure 2.41, 2.42, 2.43).

Walking towards east inside Siam Paragon (figure 2.44, 2.45), people will arrive at another entrance of the Siam station. The connection space between the station and Siam Paragon is similar to the one with Digital Gateway, with semi-outdoor space as the transition space (figure 2.46).

Figure 2.41

Figure 2.42

Figure 2.43

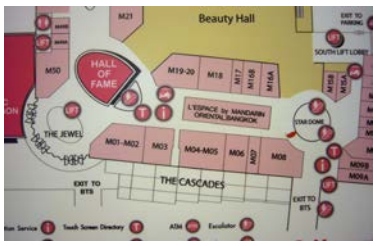


Figure 2.44

Figure 2.45

Figure 2.46

In region 3, parallel and series connections are both implemented, and the station and buildings are connected. Pedestrians do not need to go downstairs to go into buildings, which enhances the accessibility of buildings. There is one method that buildings and Skywalk connect, by (semi-) outdoor space (figure 2.47). Numerous benches are set

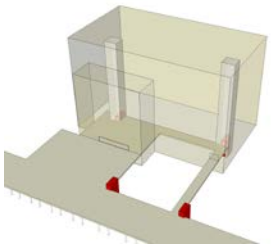


Figure 2.47

within these spaces, making them a wonderful relaxing space..

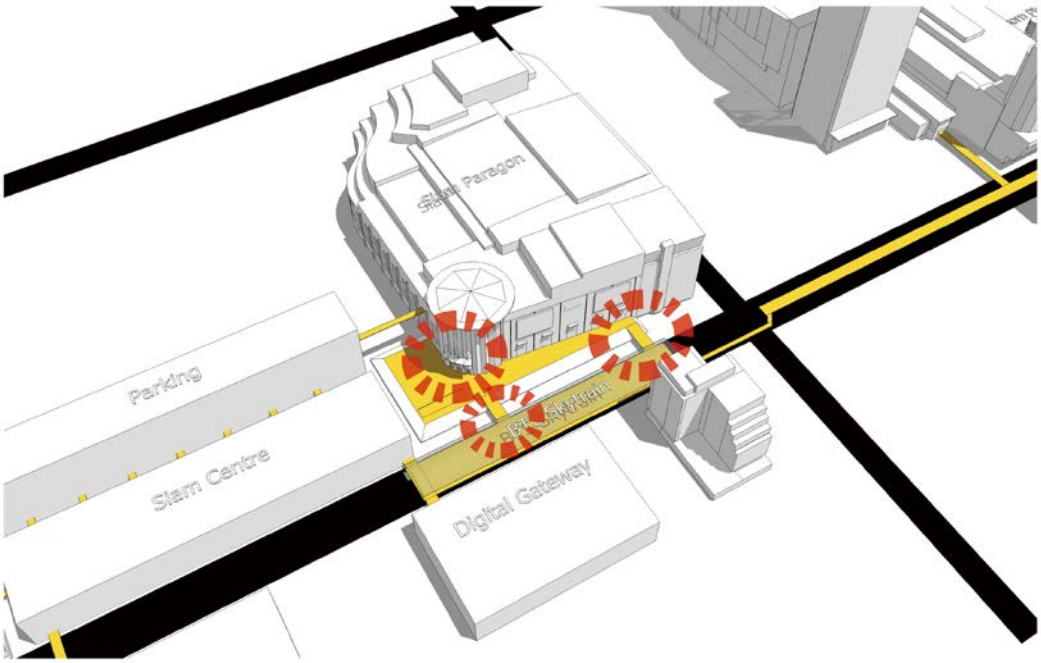


Figure 2.48

(4) Region 4: from Siam station to Chit Lom station of BTS (figure 2.54)

Starting from Siam station, the Skywalk extends to the east, crossing another intersection. The Skywalk becomes wide and completely beyond the main road. There is plenty of landscaping along the Skywalk (figure 2.49), and people can see the surrounding temples from it. During rainy days, the covers protect pedestrians, which enable them to fully enjoy walking on Skywalk.

The only thing improperly done is the concrete columns in the middle of the Skywalk (figure 2.50). They support the track beyond the Skywalk but reduce the comfort level of walking.

Figure 2.49

Figure 2.50

Figure 2.51

One bench of the Skywalk connects with a shopping mall (Central World) on the northern side. Before entering into the building, the escalator connects the elevated walkway with the ground floor (figure 2.51), which provides alternative options and adds convenience for pedestrians. There is a small stage in the lobby of the building, attracting numerous people to go into the building to watch the show. People go into

the building positively, not only to take the escalator inside the building to go downstairs.

Going up to the third floor of Central World, the signs lead people to the interior aisle at the edge of the building (figure 2.52). The aisle works as the transition space between the building and Skywalk (figure 2.54). Small shops sit along the aisle, fully express the functional support for pedestrians (figure 2.53). Later, the aisle connects with the one-level below Skywalk by two escalators.

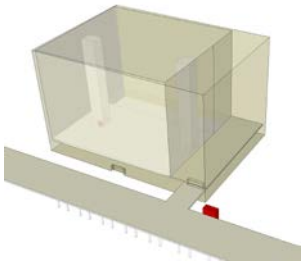


Figure 2.52

Figure 2.53

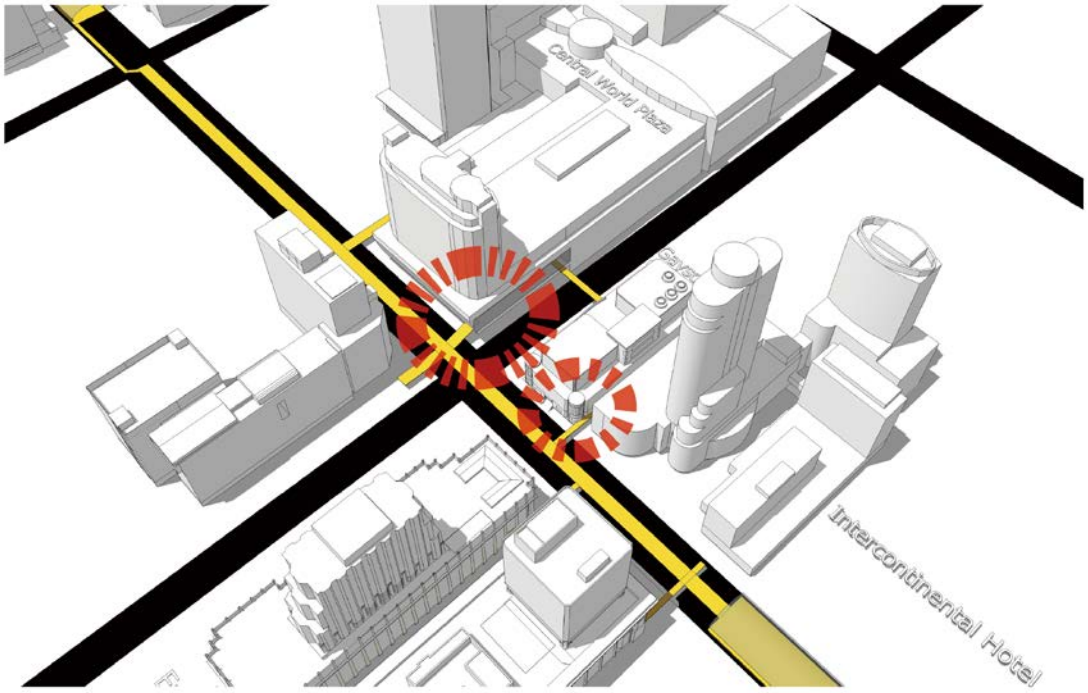


Figure 2.54

On Skywalk, handrails are set up along ramps (figure 2.55). And style of handrails changes in several part of the Skywalk, which increases the legibility (figure 2.56). The Skywalk later connects Gaysorn Plaza, Erawan Bangkok, Amarin Plaza and Maneeya Center on both sides of the road, and finally reaches the Chit Lom station.

Figure 2.55

2.2.4 Conclusion

Figure 2.56

(1) From National Stadium Station to Chit Lom Station, nearly 1500m, there are many elevated walking ways connected by buildings, forming a big pedestrian network. Pedestrians can walk on the skywalk freely without the impact of weather and vehicle, and do not need to go up and down frequently.

(2) Buildings integrate with pedestrian system in a variety of ways:

a. Skywalk connects with interior corridors (figure 2.32)

b. Skywalk connects with interior open space (figure 2.33)

c. Skywalk connects with interior platform (figure 2.34)

d. Skywalk and buildings show series connection (figure 2.37)

e. Skywalk connects with (Semi-) exterior platform (figure 2.47)

f. Skywalk connects with interior aisle (figure 2.52)

The various connection ways and transition space all express the integration of two kinds of spaces (interior space & skywalk).

(3) The integration of skywalk, buildings and stations of BTS is one of the biggest features of research area, which greatly benefits pedestrians. What is more, the extension of skywalk within the building has been embedded in a variety of shops, including retail, restaurant and bookstore. All of these contribute to pedestrian systems (figure 2.53). With the support by buildings, the high quality skywalk stimulates activities among the public. For example, in some parts of the skywalk, there are always youngsters practicing dancing, which bring fresh energy to the skywalk.

(4) However, there are still some problems in the skywalk. For example, the accessibility facilities are inadequate, handicapped could only go into the building first, and then get to skywalk by the elevator. Aside from this, the connection between BTS stations and bus stops is not well planned, they are a little bit far away from each other. Finally, some parts of skywalk do not remain open through the whole day, only open from 6:00am-12:00pm, which, to a certain extent, is not convenient to the public.

(5) Although Skywalk greatly supports walking behavior, the walking space at the ground level is barely satisfactory. The walking space is narrow and the paving shows a lack of maintenance (figure 2.57). Walkways are appropriated by vendors, selling Thai food, which force people walk on the motorway (figure 2.58). What is more, there is no traffic light in some intersections, which raise the conflict between vehicles

and pedestrians (figure 2.59). Therefore, if the pedestrian system at the ground level could be improved, it would work together with skywalk, providing the most benefits to pedestrians.

Figure 2.57

Figure 2.58

Figure 2.59

(According to the construction fee of skywalk, part of the fund came from the Bangkok Transit System Corporation, the rest came from the owners of the buildings along the skywalk. Since skywalk is always underneath BTS, BTS raised the value of the land up to 10% per square meter.[1])

[1] Craig Townsend,John Zacharias. Built environment and pedestrian behavior at rail rapid transit stations in Bangkok. Springer Science + Business Media, LLC. 2009

2.3 The Study of the Symbiotic Relationship between Pedestrian Systems and Buildings in Boston

Boston locates in the east coast of United States (figure 2.60), and it is the capital and largest city of the state of Massachusetts, with the density of 4980/ square kilometer in 2012.[1]

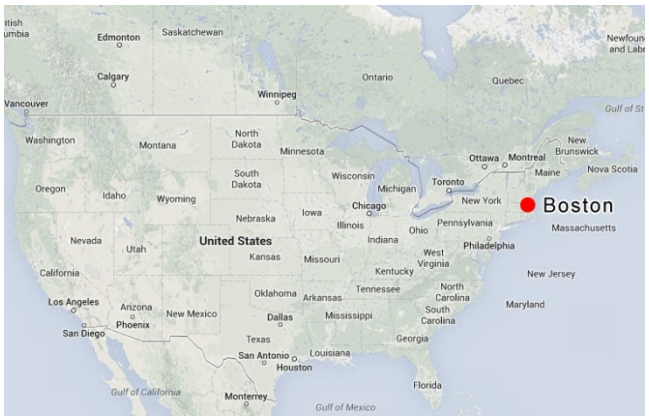


Figure 2.60

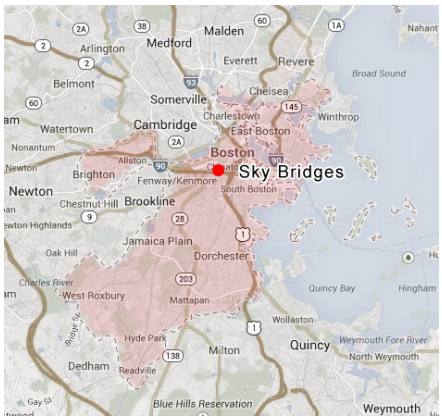


Figure 2.61

The elevated pedestrian system (sky bridges) locates in the downtown area (figure 2.61), next to Copley Square. The area can be regarded as one of the most popular places in Boston. What is more, the modern buildings connected by sky bridges are surrounded by historic buildings, which show a dramatic contrast (figure 2.62).

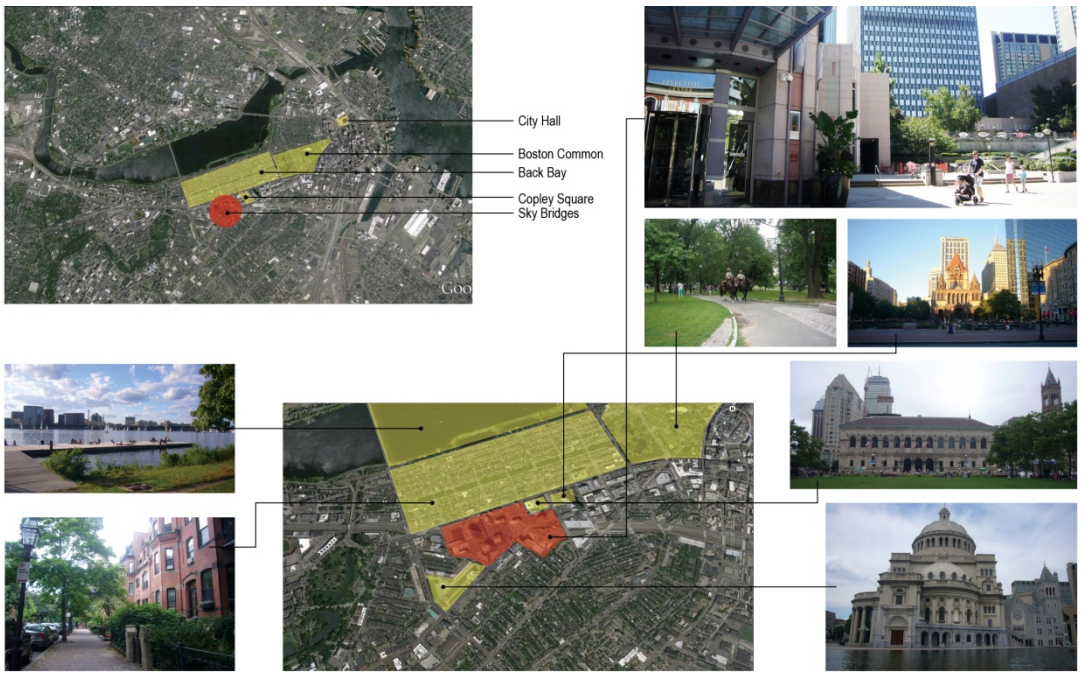


Figure 2.62

[1] "City of Boston.gov". http://www.cityofboston.gov/

2.3.1 Influence

The enclosed sky bridges fully integrate with the interior of buildings, connecting numerous buildings, such as Prudential Tower, Hynes Convention Center, The Westin Hotel, Copley Place, Belvedere Residential, 111Huntington (figure 2.63). Therefore, pedestrians are able to walk through the entire area without getting outside, which prevents bad weather during winter. And the elevated pedestrian system connects with 2 metro stations, providing great convenience to pedestrians. The desirable walkways are full of people even during nice weather, which shows the great success of the elevated pedestrian system, but at the same time, it cuts down street life at ground level (figure 2.76, 2.77, 2.79).

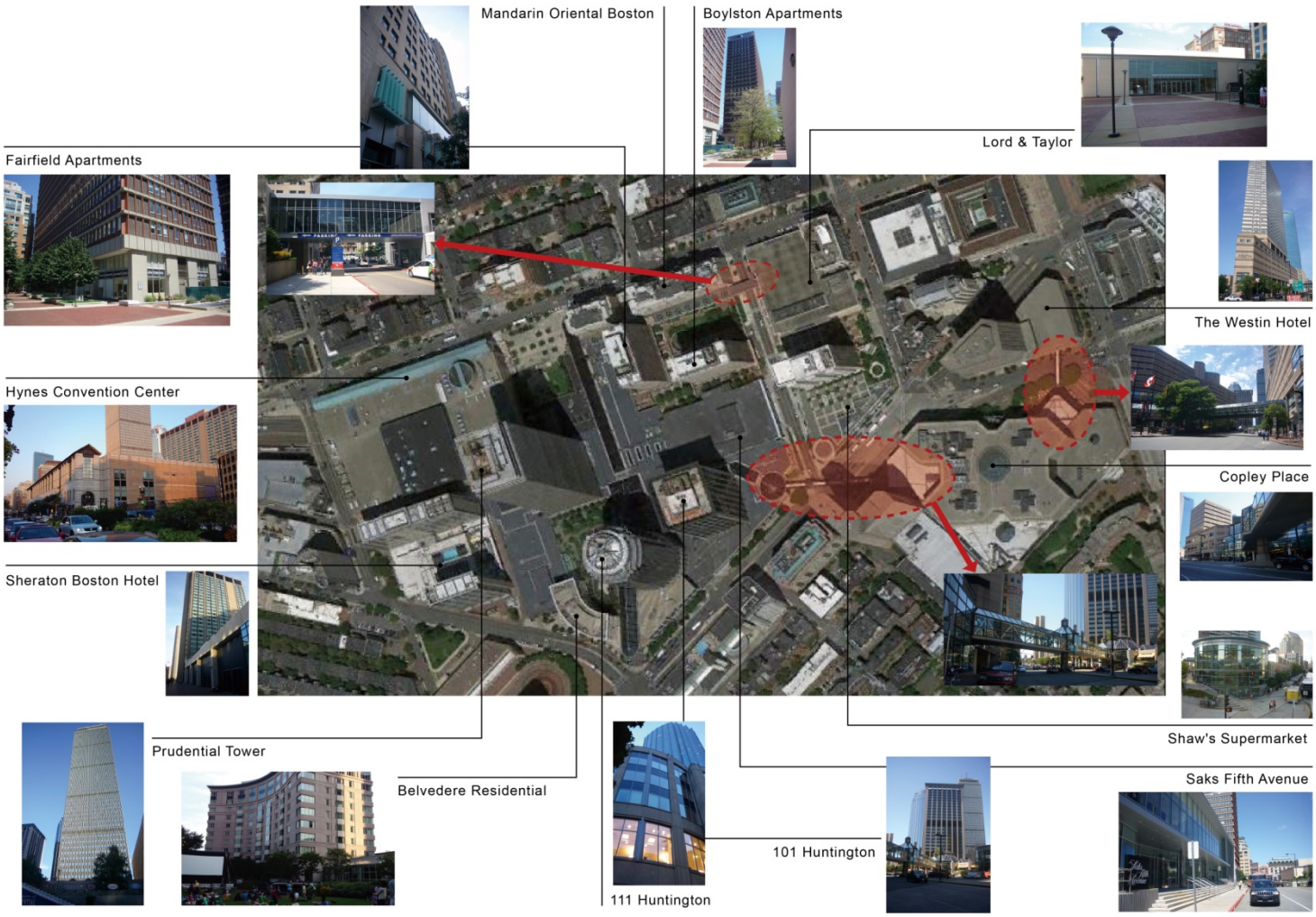


Figure 2.63

2.3.2 Symbiotic Relationship between Pedestrian Systems and Buildings

Buildings and sky bridges form a big system, in which buildings work as transition nodes. Buildings greatly support the continuity of pedestrian behavior. The entire elevated pedestrian system offers people multiple options (showed in yellow lines in figure 2.64). Walkways directly lead people to another block nearby, and one branch of the pedestrian system even extend and cross over two blocks, going through Copley Place and the Westin Hotel. As I mentioned before, two metro stations are connected by the elevated pedestrian system, which are showed in pink below.

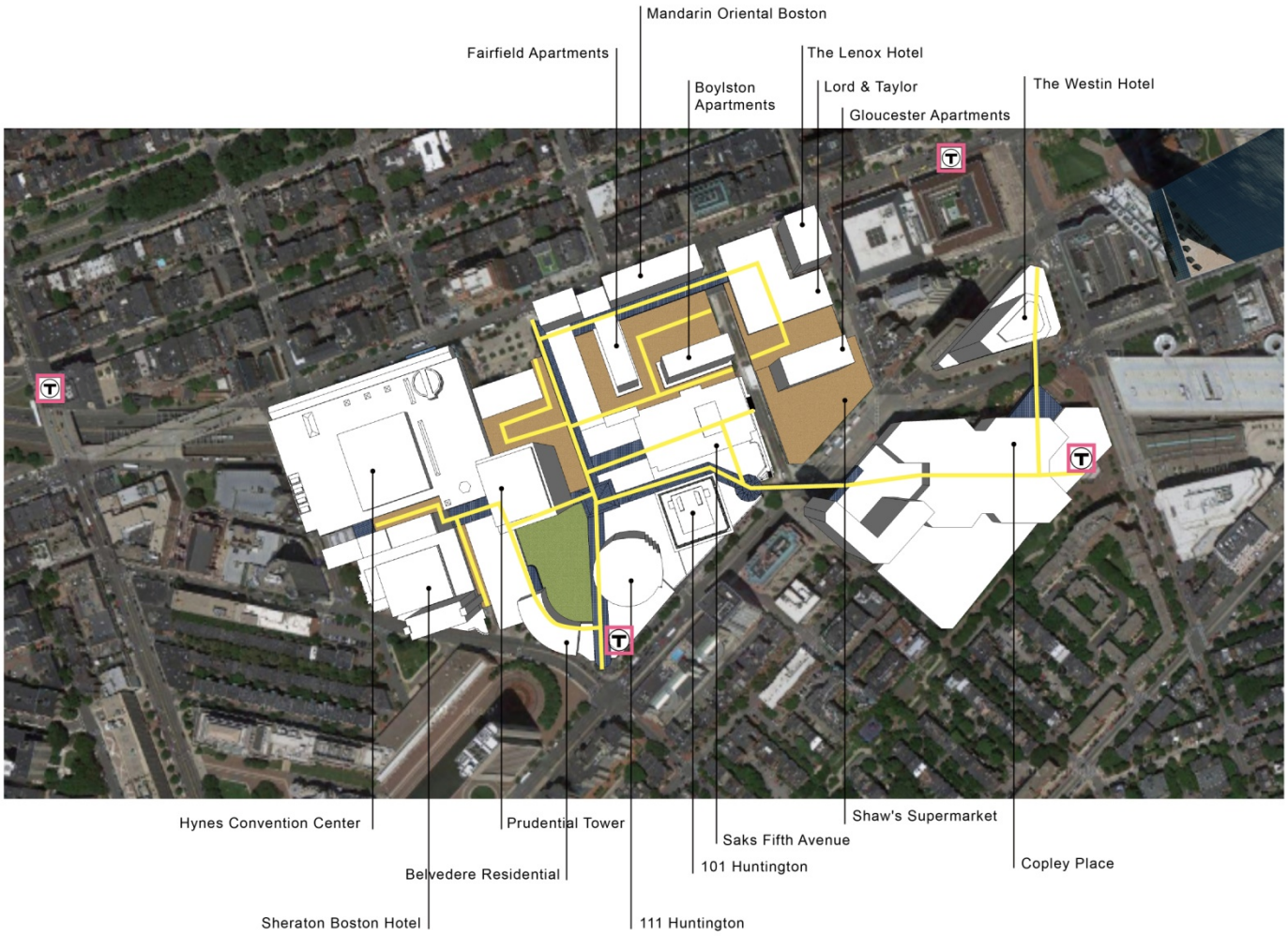


Figure 2.64

Most buildings connected by sky bridges are open to walkways at elevated level, which provides functional support for pedestrian system, and interior space of buildings and walking space fuse with each other.

There are at least 10 ways that sky bridges connect with buildings. (Figure 2.65)

(1) Buildings sit along both sides of the sky bridge (Mandarin Oriental Boston, figure 2.66)

Buildings with different functions sit along both sides of the sky bridge, opening to the public, which enlarges the walking space, as well as enriches the function of the walkway. However, the openness of buildings are limited in this case, the fusion between two kinds of spaces is not sufficient.

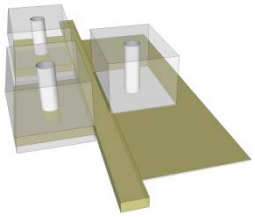


Figure 2.66

(2) Building connects with sky bridge and exterior platform (Lord & Taylor, figure 2.67)

The building works as an important node in the elevated pedestrian system. It connects two kinds of public space, and the building itself is also an enlarged functional public space. Although the transition of spaces is good enough, the function inside the building hasn't infiltrate into the sky bridge and the platform.

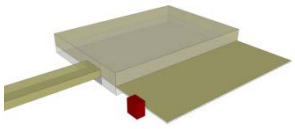


Figure 2.67

(3) Sky bridge goes through the building and connects with ground level pedestrian system (The Westin Hotel, figure 2.68)

The Westin Hotel locates at the end of the elevated pedestrian system. Although it is a hotel, it still opens the send floor to the public, and there is no clear boundary between public space and the lobby of the hotel. Therefore, it is a good example to show the integration of public space with private space.

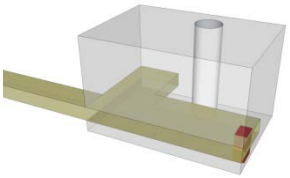


Figure 2.68

(4) Building is part of the sky bridge (Book Store, figure 2.69)

The space within the building is fully fused with the walkway outside the building. There are several openings along the edge of the building, which reduce the sense of boundary of the building. And the function inside the building, such as Starbucks, attracts people walk into the building. Thus, the function also helps to integrate two kinds of spaces.

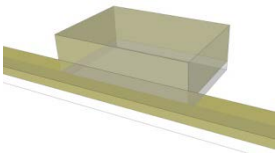


Figure 2.69

(5) Walkways Pierce through the Building (Copley Place, figure 2.70)

Similar to the example in Hong Kong (International Financial Center), several walkways meet inside the

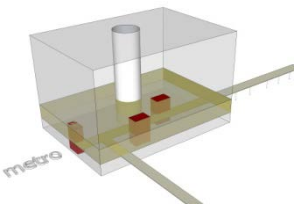
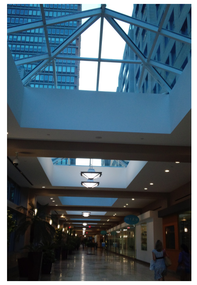
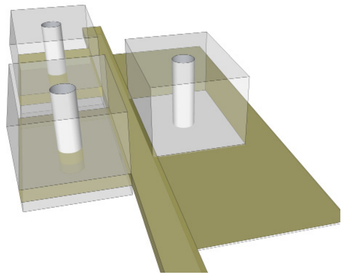
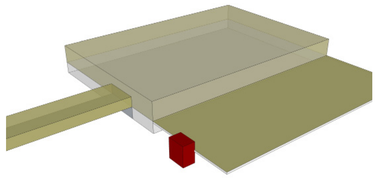


Figure 2.70

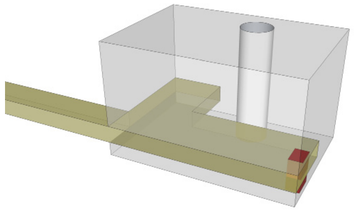




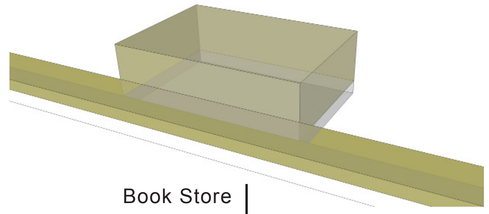
Mandarin Oriental Boston



Lord & Taylor

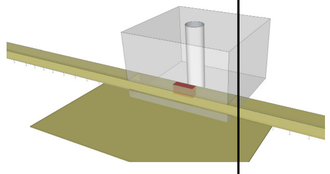


The Westin Hotel

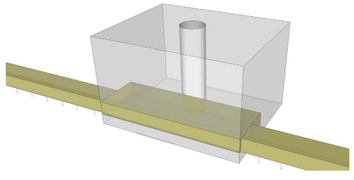


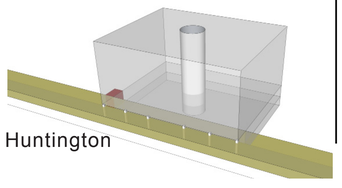
Book Store

Prudential Tower

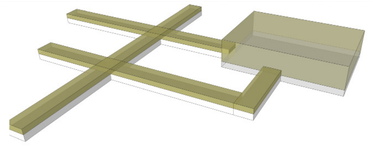


Belvedere Residential

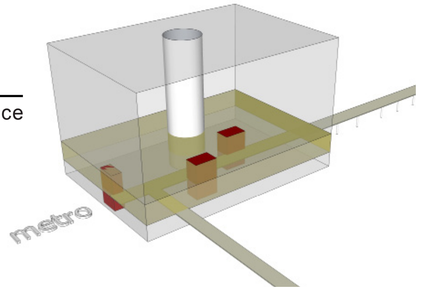




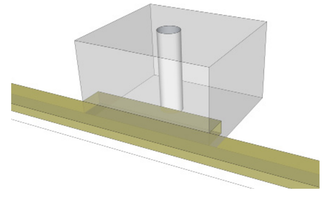
111 Huntington



Saks Fifth Avenue



Copley Place



101 Huntington

Public Space

Escalator/Stairs to the Ground

Figure2.65 Connection Methods between Buildings and Pedestrian Systems

building. The building works as a transit space at the elevated level, and at the same time, it also carries vertical circulation. It is an essential node in pedestrian system, connecting with metro station. The functions inside the building are restaurants, drink shops and retails, which are related to our daily life. Therefore, it is one of the most popular places in the area.

(6) Building sets back from the walkway, leaving more space for the public (101 Huntington, figure 2.71)

101 Huntington is a private building, but it still sets back from the public walkway, providing a enlarged transit space for the public.

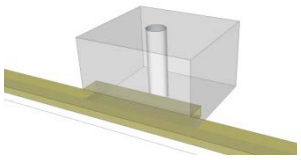


Figure 2.71

(7) Building connects one branch of the main walkway (Saks Fifth Avenue, figure 2.72)

It is an optional to cross though the building, so the importance of the building in the pedestrian system is not as obvious as mode 5 (Copley Place). But the building still contributes to the pedestrian system, and offer functional support for pedestrians.

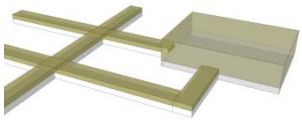


Figure 2.72

(8) Walkway goes along the edge of the building, and connects with a roof garden (Prudential Tower, figure 2.73)

The edge of the building is soften by two kinds of public space, one is the main walkway, the other one is an open roof garden. Therefore, the interior space is fully integrated with exterior space, serving for the public. What is more, the roof garden is completely surrounded by interior walkways, which makes it a popular space. Activities such as games for families with children, night movie show are held on the roof garden (figure 2.80).

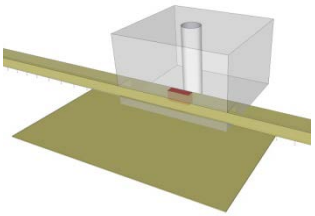


Figure 2.73

(9) Building sets back from the walkway, landscape inside the building enriches the view from walkway (111 Huntington, figure 2.74)

Similar to 101 Huntington, the private building sets back from the walkway. Since the boundary is totally made by glass, pedestrians can see the landscape inside the building. There is a big artificial waterfall facing directly to the walkway, which shows another functional support to the pedestrian system.

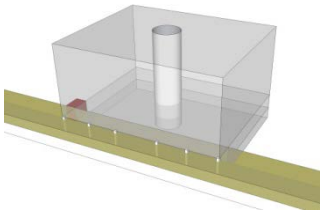


Figure 2.74

(10) Walking space is enlarged in the portion of inside the building (Belvedere Residential, figure 2.75)

The change of the space creates a more diverse space

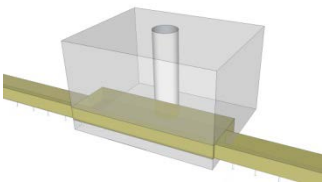


Figure 2.75

experience, and more functions are able to be filled in, in order to support pedestrian behavior.

As for ground level, since the perfect walking environment in elevated pedestrian system, less people are willing to walk on the street in some parts of the area. Thus, the street life is reducing (figure 2.76, 2.77), which is opposite to its surrounding historical area (figure 2.78). What is more, the sidewalks at street level are always interrupted by vehicles in terms of numerous parking entrances (figure 2.79).

Figure 2.76

Figure 2.77

Figure 2.78

Figure 2.79

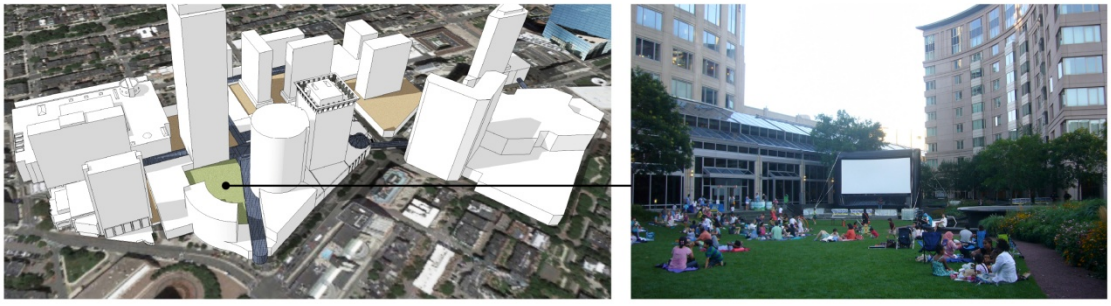


Figure 2.80

Figure 2.81 and 2.82 below show how the elevated pedestrian system connect with metro station. Two kinds of spaces connect well, which great support the continuity and efficiency of pedestrian flow.

Figure 2.81

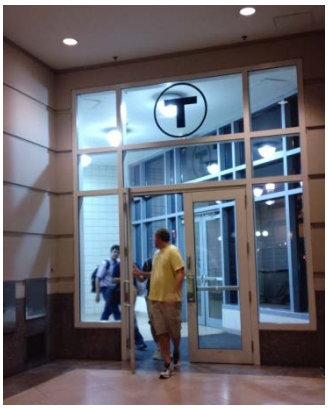


Figure 2.82

Figure 2.83

Figure 2.84

The accessibility facilities are well designed in the entire area, which enable different kinds of people move conveniently. Figure 2.83 shows the access to a shop along the interior walkway, you can see clear stairs and ramp. Figure 2.84 was taken inside one building, showing the access to a metro station. People can go directly to the metro station without going outside. The elevator sits just near the escalators and stairs.

2.3.3 Conclusion

(1) Buildings and the elevated pedestrian system formed one big system in the research area. Buildings work as transit nodes, connecting several parts of the elevated walkways. The space within buildings and the enclosed corridors infiltrate into each other. Overall, the elevated space is quite enjoyable and convenient. However, the wonderful elevated interior space cause the decline of street life at ground level, which, to a certain extent, does not match with the feature of the city. Street life is important to Boston, since to me, Boston can be regarded as a walkable city, the famous freedom tail is the best example.

(2) Buildings integrate with pedestrian system in a variety of ways:

a. Buildings sit along both sides of the sky bridge (Mandarin Oriental Boston, figure 2.66)

b. Building connects with sky bridge and exterior platform (Lord & Taylor, figure 2.67)

c. Sky bridge goes through the building and connects with ground level pedestrian system (The Westin Hotel, figure 2.68)

d. Building is part of the sky bridge (Book Store, figure 2.69)

e. Walkways Pierce through the Building (Copley Place, figure 2.70)

f. Building sets back from the walkway, leaving more space for the public (101 Huntington, figure 2.71)

g. Building connects one branch of the main walkway (Saks Fifth Avenue, figure 2.72)

h. Walkway goes along the edge of the building, and connects with a roof garden (Prudential Tower, figure 2.73)

i. Building sets back from the walkway, landscape inside the building enriches the view from walkway (111 Huntington, figure 2.74)

j. Walking space is enlarged in the portion of inside the building (Belvedere Residential, figure 2.75)

(3) The elevated pedestrian system connects two metro stations (figure 2.64), providing convenience to pedestrians, and make the walking on elevated level more efficient than ground level.

Functions inside the research area are diverse, especially along the walkways. Numerous shops (food shops, retail stores, book stores, etc.) sit along the walkway supported by buildings, which greatly enrich the function of the elevated pedestrian system.

(4) Sufficient accessibility facilities (figure 2.81, 2.82), shade design (the sky bridges are all enclosed) and interior landscape (figure 2.85) increase the comfort level of walking space. Glass roof allow sunshine goes into the corridor, which adds more dynamic to the space (figure 2.86).

Figure 2.85

Figure 2.86

(5) However, some corridors only have the function of circulation, which makes the long walkway a little bit boring and to a certain extent, reduces the comfort level of pedestrian system (figure 2.83, 2.84).

Figure 2.87

Figure 2.88

Chapter 3 Assessment Methodology of the Symbiotic Relationship between Pedestrian Systems and Buildings

3.1 Introduction

Buildings create spaces in cities, and building environments directly affect human behavior. Pedestrian systems have a close relationship with our daily life. Buildings are playing vital roles in urban public space, such as offering public space within buildings, supporting the function needed by the public, improving the environment of public space, and working as nodes to reconcile the contradiction between vehicles and pedestrians. In order to make these roles implemented, a symbiotic relationship between pedestrian systems and buildings is highly advocated. Therefore, the planning of pedestrian system should not only be combined with public transportation, but also be integrated with the surrounding buildings.

In this chapter, I demonstrate the relationship between pedestrian systems and buildings first. Then based on the analysis of Hong Kong, Bangkok and Boston, together with previous study on related theories, I propose the Assessment Methodology of the symbiotic relationship between pedestrian systems and buildings, in order to set up a frame for the coming study.

3.2 Relationship between Pedestrian Systems and Buildings

The relationship between pedestrian systems and buildings could be summarized into 2 aspects.

(1) According to space, there are single level and multi-level (figure 3.1). Single level: pedestrian systems and buildings connect with each other at one level, such as the relationship between sidewalk on the ground level and buildings. Multi-level: pedestrian systems and buildings connect with each other at different levels. For example, second floor and ground floor of

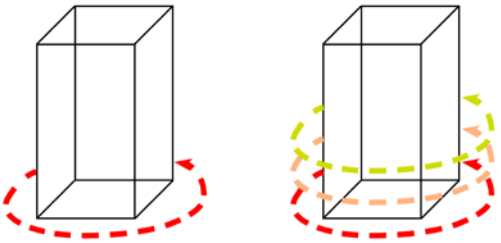


Figure 3.1

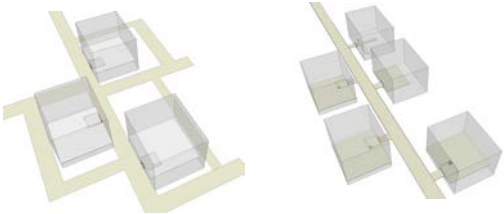


Figure 3.2

the buildings connect with elevated walkways and streets.

(2) According to the connection method, there are walking-round connections, parallel connections (figure 3.2) and series connections (figure 3.3). Walking-round connection: no relationship between buildings and pedestrian systems occurs under such situation, only few users go into the building from pedestrian systems. Parallel connection: most of the connection area is public space, therefore numerous pedestrians can go into buildings. Series connection: pedestrian systems cross through buildings, pedestrians can go through one building and get to another building. Nowadays the relationship between pedestrian systems and buildings are mostly walking-round connection and parallel connection.

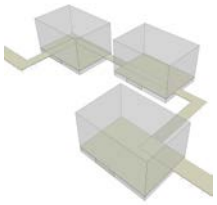


Figure 3.3

In the symbiotic relationship between pedestrian systems and buildings, buildings and pedestrian systems would form a big system. There is no isolated element inside the system. Buildings and walkways connect with each other at different levels, besides parallel connection, there are more series connections. Therefore, buildings would work as nodes to support the continuity of walking and provide functional support, as well as to reduce the competition between vehicles and pedestrians. Hence the walking space would be greatly improved.

3.3 Assessment Methodology of the Symbiotic Relationship between Pedestrian Systems and Buildings

On the basic of the analysis on Hong Kong, Bangkok and Boston, I propose 5 aspects to evaluate the symbiotic relationship between pedestrian systems and buildings, which are a continuity of pedestrian behavior supported by buildings; integration degree between pedestrian space and buildings; functional support for pedestrian systems by buildings; comfort level and the sense of place; sustainability.

3.3.1 Continuity of Pedestrian Behavior supported by Buildings (figure 3.4)

The continuity here does not mean to simply connect sidewalks on both sides of the road by using underground and elevated walkways. Such a method would only be passive solution to reduce the conflict between vehicles and pedestrians, and it does not consider the convenience and efficiency of transportation for pedestrians.

Therefore the continuity of pedestrian behavior supported by buildings could be

represented by: whether buildings work as transition nodes in pedestrian systems, connecting each part of the walkway; whether buildings and pedestrian systems form one big system, enable pedestrians to go anywhere without interrupted by vehicles.

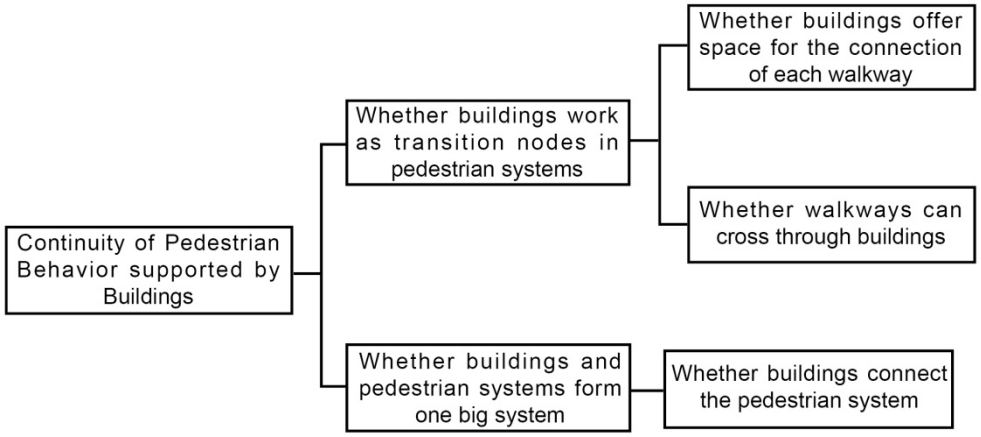


Figure 3.4

Specifically, the category could be subdivided by: whether elevated or underground walkways can cross through buildings, in order to avoid the interruption of walking by vehicles on ground level; or whether buildings offer space for the connection of each walkway. In Hong Kong, Bangkok and Boston (figure 2.4, 2.23, 2.65), buildings connect each part of the walkway. Hence, walking is not interrupted by vehicles and pedestrians do not need to go upstairs and downstairs frequently, which fully expresses the support for pedestrian systems by buildings.

3.3.2 Integration Degree between Pedestrian Space and Buildings (figure 3.5)

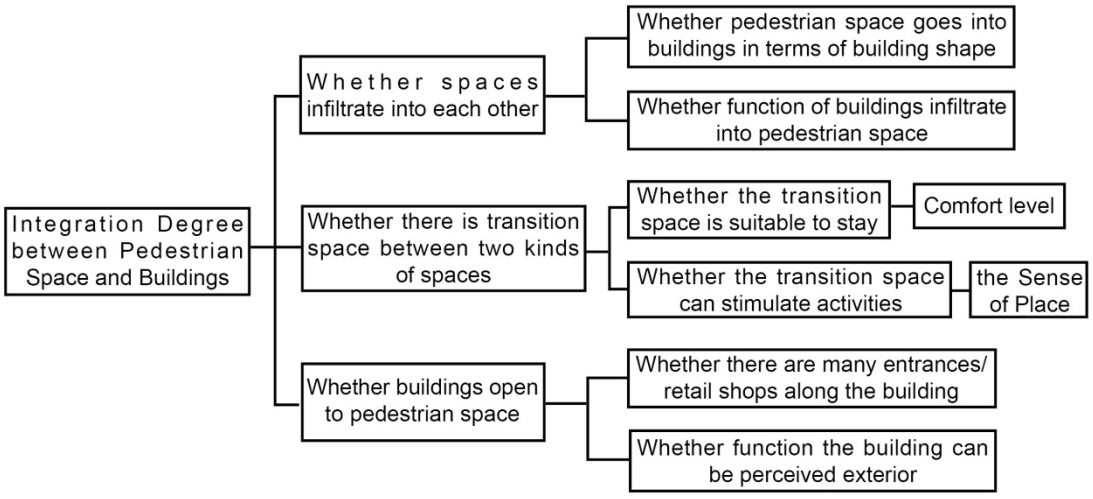


Figure 3.5

The integration degree between pedestrian space and buildings could be represented by:

(1) Whether spaces infiltrate into each other

This category includes: whether pedestrian space goes into buildings in terms of building shape, and the infiltration of two functions. The way buildings and pedestrian systems integrate with each other in Bangkok (figure 2.37), and (1) (2) in Hong Kong (figure 2.5, 2.6), and (5) in Boston all show the infiltration of two spaces. What is more, the integration of buildings and sidewalks in Hong Kong also show a great fusing of two kinds of spaces (figure 2.13-2.18). Besides the examples in Hong Kong, Bangkok and Boston, there are a variety of connection ways, see figure 3.7.

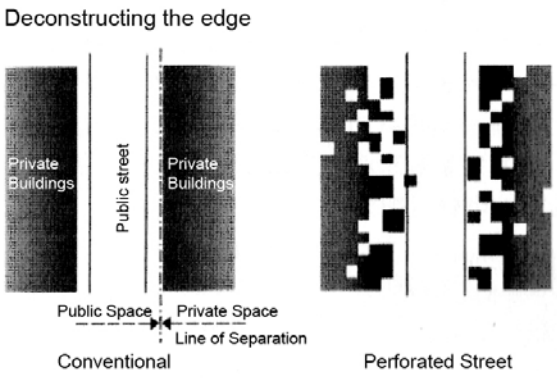


Figure 3.6

The infiltration of two functions means that the boundary of the building is also part of public space served for pedestrian systems. The semi-platform between the building and Skywalk in Bangkok is a good example (figure 2.47).

The infiltration of spaces show the great openness of buildings, which reduce the boundary of building space and walking space (figure 3.6), making buildings essential nodes in pedestrian systems.

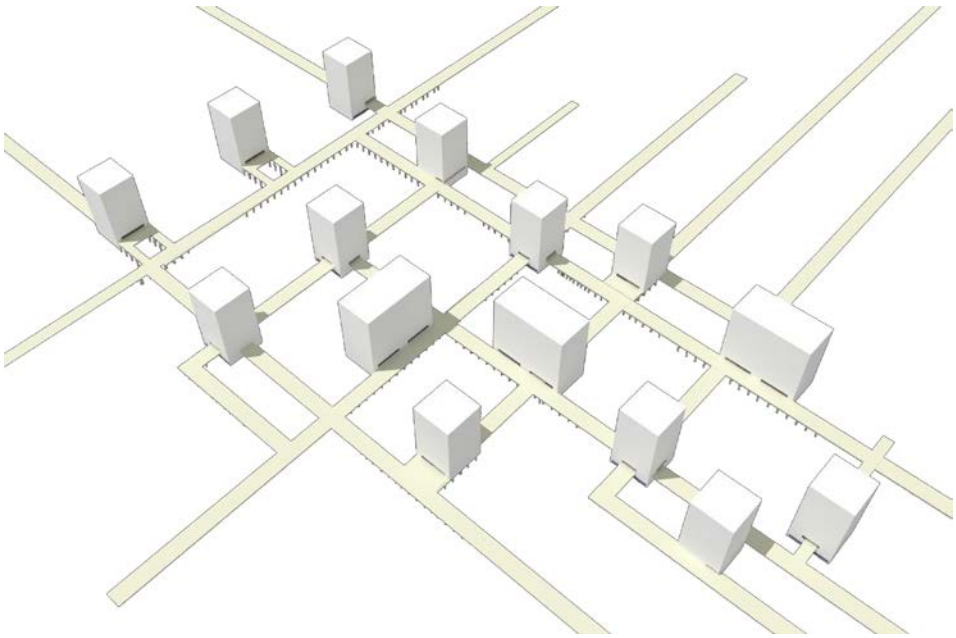


Figure 3.7

(2) Whether there is transition space between two kinds of spaces (figure 3.8)

The enlarged transitional space could not only reduce the pressure of traffic flow, but increase the diversity of space, and offer pedestrians a relaxing area, which could stimulate activities.

In Bangkok, there are many examples showing that buildings and the Skywalk are connected with each other through enlarged transition space (figure 2.33, 2.47). Moreover, youngsters always practice dancing on the wide Skywalk (figure 2.30). In Hong Kong, (1) and (6) show the management on transition space (figure 2.5, 2.10). Figure 2.73 and 2.75 of Boston are also good examples. And at ground level, the plaza in front of the entrance, the enlarged lobby inside the building and the set back area all work as transition space.

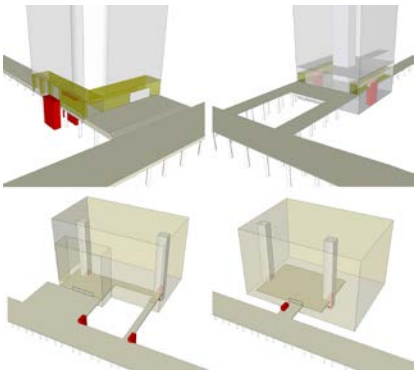


Figure 3.8

(3) Whether buildings open to pedestrian space

Buildings and pedestrian systems should not be separated with each other, especially in city centers, the ground level of buildings could open to sidewalks. Open not only means the entrances, but also small shops open to pedestrian ways, such as the World Wide House (figure 2.9, 2.18), which reduce a sense of hard boundary of the building, enhancing the integration of building space with walking space. However in Bangkok, although buildings greatly serve the Skywalk, the ground floors do not open to the public, such as Siam Center (figure 3.9). Pedestrians cannot feel the interior function from its solid wall, which isolate the building and walkway. The similar situation happens in Boston, solid walls and parking exits (figure 2.77, 2.79) reduce the street life.

Figure 3.9

3.3.3 Functional Support for Pedestrian Systems by Buildings (figure 3.10)

The functional support for pedestrian systems by buildings could be represented by:

(1) Whether buildings integrate with public transport (figure 3.11)

In high-density city centers, public transportation is an important way to carry huge amount of people. The combination between transportation nodes and buildings would greatly benefit the pedestrians, and also bring more business to buildings.

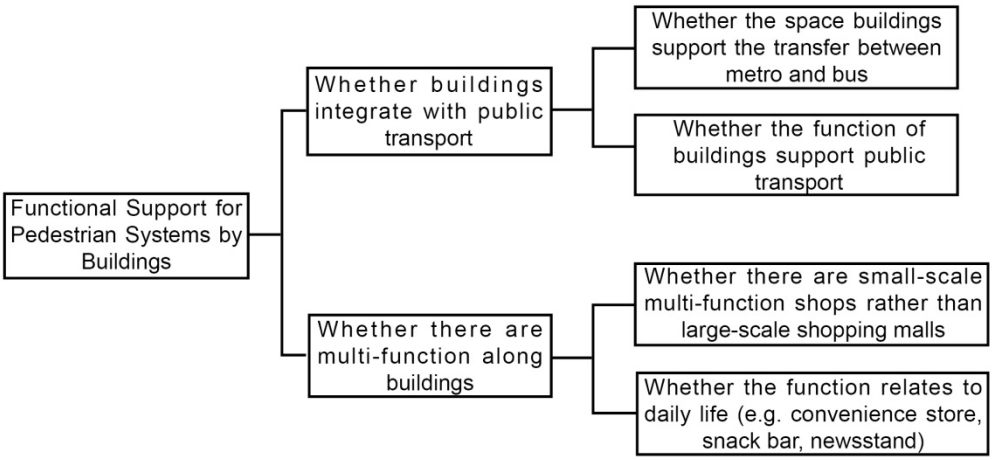


Figure 3.10

Ideally, buildings not only integrate with metro stations at underground level, but also connect with bus stops at ground level, in order to work as transition nodes, fully support working behavior. For example, in Hong Kong, numerous bus stops sit at the ground floor of buildings (where part of the ground floor is unenclosed) (figure 2.19). Besides, the function at the ground floor of buildings should serve more for transition nodes, in order to offer more functional support for pedestrians.

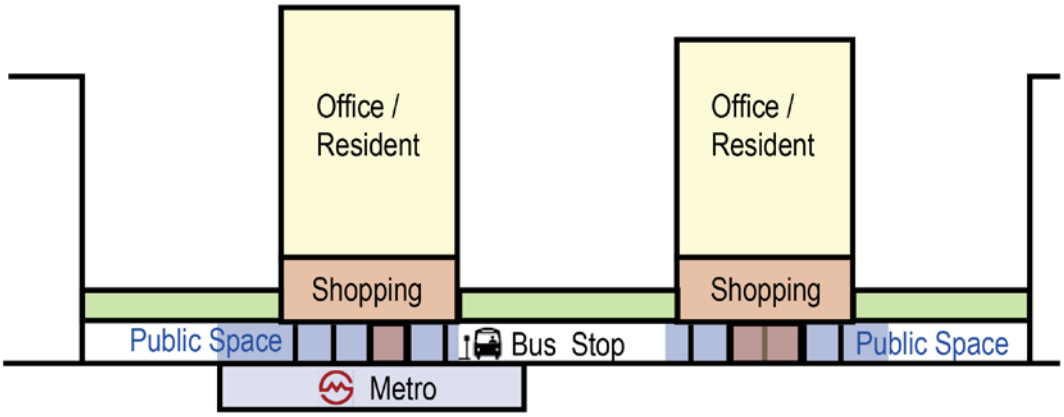


Figure 3.11

(2) Whether there are multi-function along buildings (figure 3.12)

Small scale shops, which closely related to our daily life, are the main factors to support walking behavior. Multi-functional buildings could attract different kinds of people. Especially at the ground floor of buildings, diverse shops would lead the walking behavior infiltrate into buildings, enhancing the relationship between buildings and pedestrian systems. Also, the multi-function shops could stimulate diverse activities. For example, the interior aisle between Skywalk and Central World Plaza (figure 2.52), and in Hong Kong and Boston, figure 2.9, 2.15, 2.17 and figure 2.86 all show the multi-function along buildings. Among this connection area, small

shops such as restaurants, retails, bookstores fully open to walkways, meeting the needs of different people.

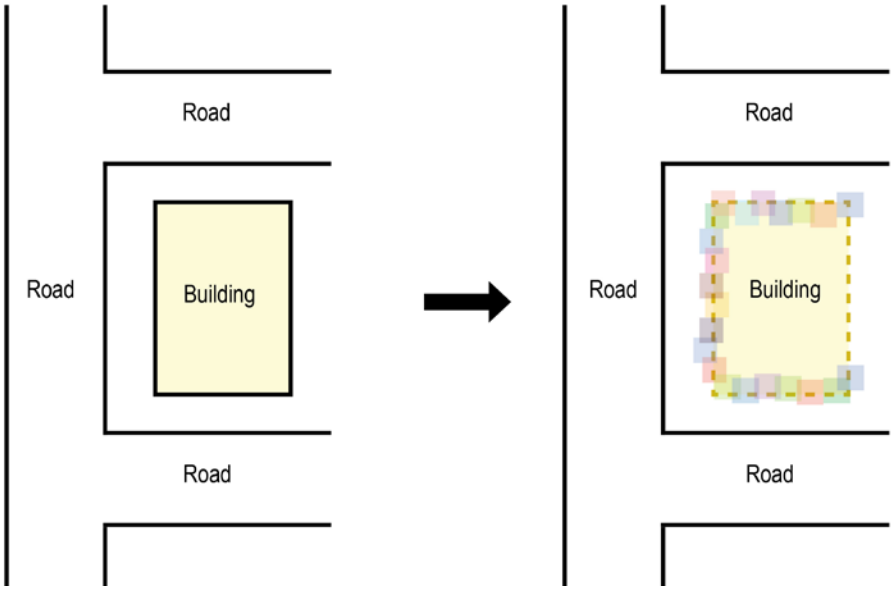


Figure 3.12

3.3.4 Comfort Level and the Sense of Place (figure 3.13)

Service facilities inside buildings and in walking space would attract more people, and create a better walking experience. Therefore the comfort level should be included (figure 3.14): hardware facilities (accessibility facilities, shading devices, benches, traffic signs, telephone booths, restrooms, green space, landscape, sculptures); software facilities (detail design, background music, decoration, light, service). In Hong Kong, Bangkok and Boston, the accessibility facilities are comprehensive (figure 2.11, 2.55), and the shading devices are completed (figure 2.12, figure 2.31, figure 2.85), which creates desirable walking environment.

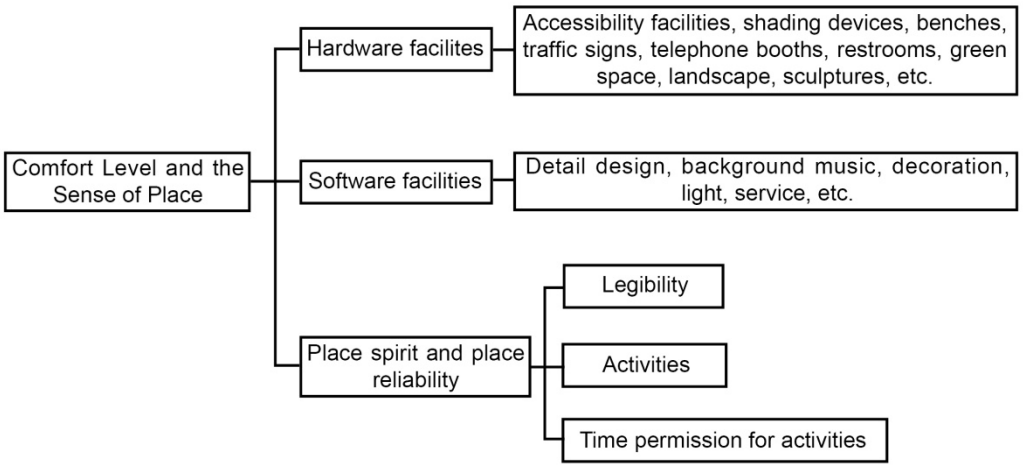


Figure 3.13

The sense of space: “space charged with meaning, that reflects the distinctive character of human embodiment in the full range of its moving, emotional, and social capacities.”[1]. And also, the timing for activities is ensured. For example, the elevated walkway in Hong Kong is open to the public during the whole day. While Skywalk in Bangkok is not open from 12pm to 6am, which is not appropriate for Bangkok famous for night market.

Figure 3.14

3.3.5 Sustainability/Future Flexibility (figure 3.15)

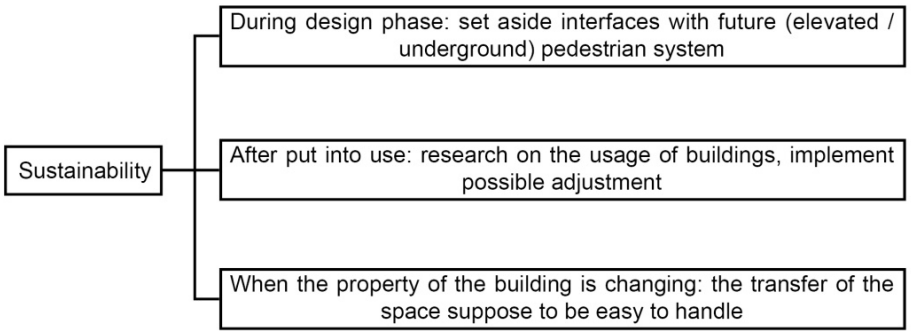


Figure 3.15

(1) The Hong Kong government encourages owners of buildings to set up multi-level walkways in newly-built areas, and make them connect with existing pedestrian systems[2], to complete the multi-level pedestrian systems in the entire city. This method fully considered about the sustainable development of pedestrian systems. Therefore, if we set aside interfaces with future (elevated/underground) pedestrian system, it would benefit the whole city.

(2) Research on the usage situation after buildings being put into use is important to sustainable development. There might be some differences between designers’ intentions and the real usage of buildings, so possible modification is needed, to better fuse buildings into the surroundings.

(3) The function of buildings might change with the passing of time, and the relationship between buildings and pedestrian systems would accordingly alter. For example if the building space changes from public into private, the connection area between the building and walkway would transfer from open to semi-open or close to the public. Therefore, if the changeable situation being considered during the design phase, it would be easier to transfer functions inside the building. And what is more, the characteristic of each area should also be taken into consideration, which would contribute to the sustainable development of the whole system formed by buildings and pedestrian ways.

[1] David Morris. *The Sense of Space*. SUNY series in Contemporary Continental Philosophy, 2012 (2)
[2] Lei Shan. *The Study of the Multi-Level Pedestrian Systems in City Centers*. China Urban Planning Symposia, 2011

Chapter 4 Analysis of the Symbiotic Relationship between Pedestrian Systems and Buildings of Three City Centers in Shanghai

Shanghai is the largest city in China (figure 4.1), having 17 districts. It totals 6340.5 square kilometers, which is 4 times the area of Oahu. The average density is 3631/square kilometer, while in city centers, the density is 16828//square kilometer.[1]

Wujiaochang (in Yangpu district) and Xujiahui (in Xuhui district) are included in the "4 sub-center of Shanghai". Lujiazui (in Pudong district) is the first National financial development zone of China (figure 4.2). Metro system goes through the three areas, which brings in huge amount of people every day. However, there remain many problems in pedestrian systems of these three areas. Therefore I want to study on these areas and solve the existing problems by implementing the symbiotic relationship between buildings and pedestrian systems. To be specific, by utilizing the assessment methodology proposed in the last chapter, I analyze the symbiotic relationship between buildings and pedestrian systems in terms of space, function and comfort level, in order to figure out the solution and design strategy.

Figure 4.1

Figure 4.2

4.1 Study on the Symbiotic Relationship between Pedestrian Systems and Buildings in Wujiaochang, Yangpu District

[1] http://finance.sina.com.cn/china/dfjj/20130129/074614433388.shtml. Last modified 2013/01/29.

Figure 4.3 Wujiaochang in 1990s

Figure 4.4 Wujiaochang Nowadays

Wujiaochang sits in the northeast corner of Shanghai. It is a great public space serving for Yangpu district (21806/square kilometer)[1]. And the functions include commerce, office, entertainment, residence and sports.

4.1.1 Construction Process of Wujiaochang

The redevelopment of Wujiaochang started in 1996 (figure 4.3, 4.4). In September 1996, the construction office was set up; in 1998, the moving of residences in the southern part of Wujiaochang started. And after that, the Science Building and Hu Dong Finance Building was built (figure 4.5). In April 2003, the construction of elevated highway was started. One month later, the planning competition for Wujiaochang was opened to the world, and the final scheme was the combination of the proposals raised by SBA, Dayuan Institute and Tongji urban planning design and research institute.[2] In 2004, the construction of Wanda Plaza and Bailian started (figure 4.6). In 2006, the underground plaza, Wanda Plaza and Bailian was put into use. Till the end of 2012, the commercial area reached 1,400,000 square meters (figure 4.7).[3]

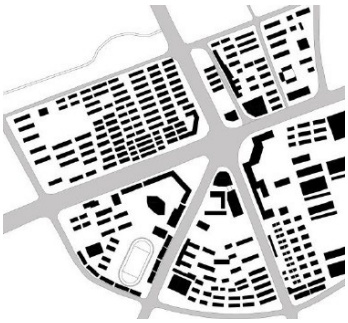


Figure 4.5

Figure 4.6

Figure 4.7

After exploration and construction over several years, the development of Wujiaochang went from urban planning to detailed project design and is gradually being completed.

4.1.2 Range of Research and Current

[1] "Shanghai Statistical Yearbook". http://www.stats-sh.gov.cn/tjnj/nj12.htm?d1=2012tjnj/C0202.htm.
[2] Li Hong. *International design competition for Wujiaochang*. Ideal Space, 2004(2)
[3] "The Past and Present of Wujiaochang". Last modified 12 January 2012, http://sh.focus.cn/news/2007-06-21/326979.html

Situation

(1) Research area

Making the center of the underground area as the centre, the research area covers 400 radii (around 10 minutes walking distance). Figure 4.8 in blue and figure 4.9.

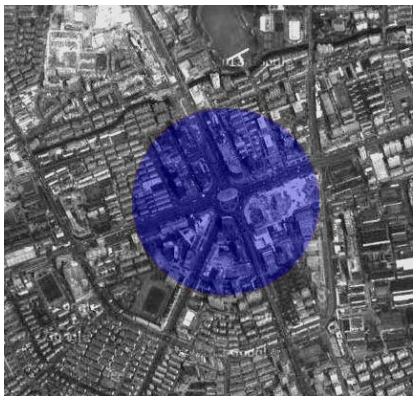


Figure 4.8

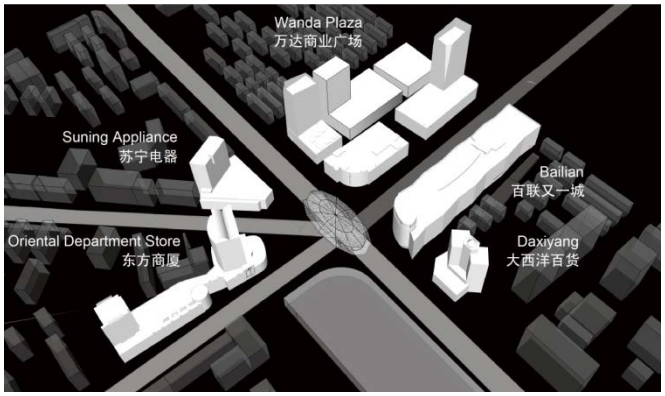


Figure 4.9

(2) Current situation

a. Function (figure 4.10)

The functions included in the research area include commerce, office, residential and school. We can see from the diagram that commercial buildings sit around the central circle, surrounded by residential buildings. Thus, there is enough density to support the commercial area. And schools increase the diversity of people.

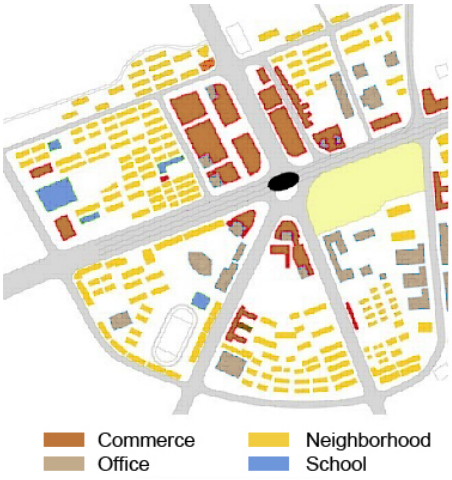


Figure 4.10

b. Transportation node

There are 8 bus stops spread in Wujiaochang (figure 4.11). However, only two of them sit in the commercial area. And the other six sit at the edge of the commercial area, which makes it inconvenient for pedestrians.

In addition, metro line 10 goes through Wujiaochang, bringing in huge amount of people every day

c. Attractive places

The attractive places, by that I mean the places with a lot of people visiting, include the commercial buildings, tourist attractions and office buildings. Firstly, there are several commercial buildings in Wujiaochang, including Wanda Plaza, Bailian, Daxiyang, Suning and the Appliance and Oriental Department Store (figure 4.9). Having shopping malls, restaurants and entertainment inside commercial buildings, people with different ages or interests can all find their preferred ways to relax. Secondly, different zones, such as office building, residence and school, increase the

diversity of the population structure. Third, the “colorful egg” (figure 4.4) is a famous landmark in Wujiaochang. Especially during nights, the light performance on the “colorful egg” becomes the main attractive point of Wujiaochang.

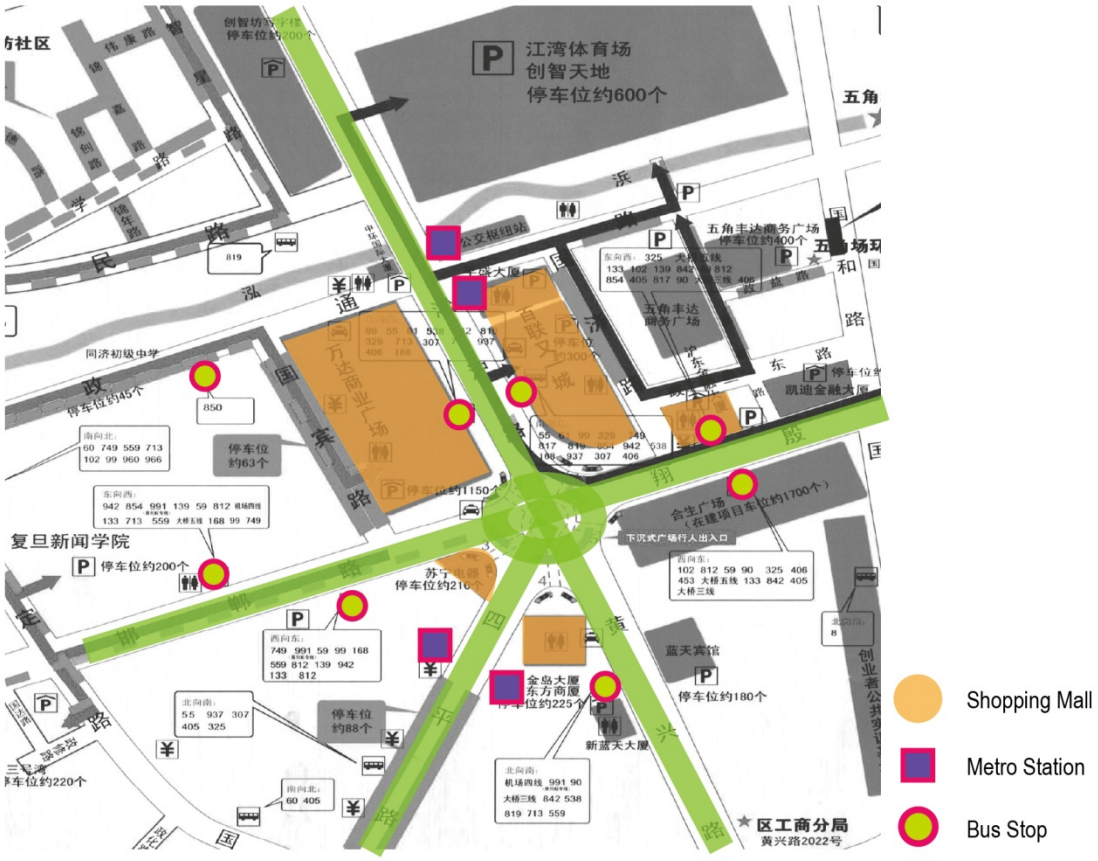


Figure 4.11

It is reported (2013) that 240,000 people going out in Wujiaochang during weekdays, while 350,000 people during weekends. During weekdays, 39% of the 240,000 are going out for shopping, and 29% for work. During weekends, 47% of the 350,000 people visiting Wujiaochang go for shopping, and 21% for entertainment.[1]

4.1.3 Analysis of the Symbiotic Relationship between Pedestrian Systems and Buildings

4.1.3.1 Continuity of Pedestrian Behavior supported by Buildings

Within the research area, the pedestrian system at the ground level is interrupted by traffic roads (figure 4.12). However, the underground pedestrian system is much better. Although the accessibility is limited in certain areas, it does connect main commercial

[1] Liu Tao, Xu Xiaodong. *Traffic Planning of Wujiaochang*. Traffic and Transportation, 2012 (1)

buildings in Wujiaochang (figure 4.13), providing great convenience for pedestrians. But buildings contribute less to pedestrian systems in my research area.

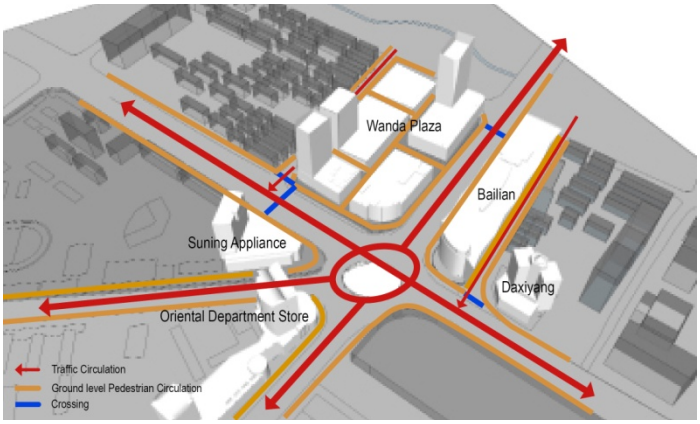


Figure 4.12

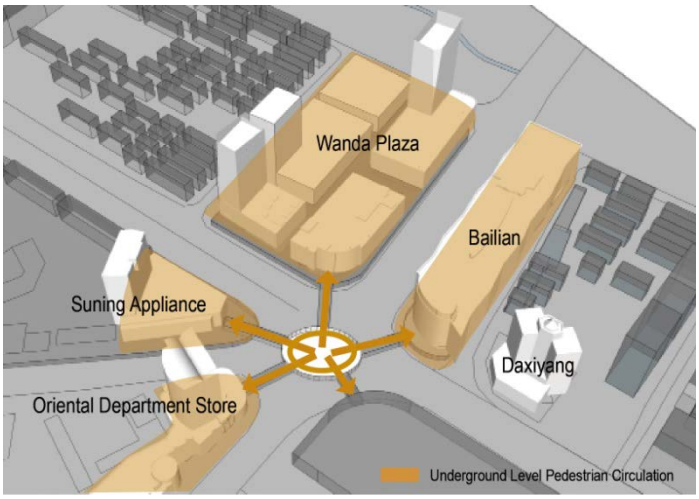


Figure 4.13

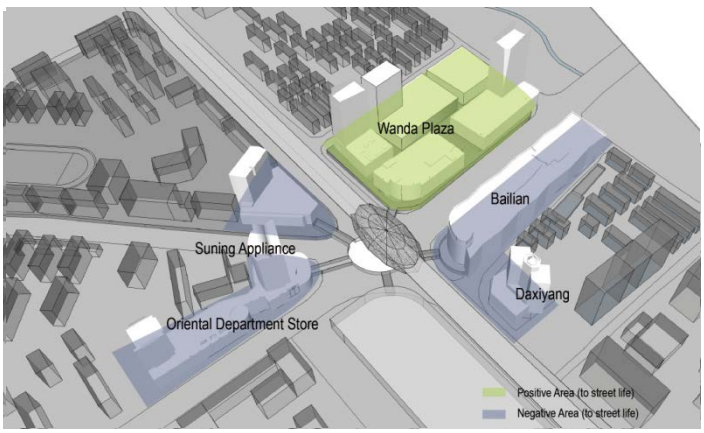


Figure 4.14

(1) Ground level

As the sub-center, Wujiaochang has a huge amount of traffic. It was reported in 2012 that there were 10,493 vehicles per hour during weekdays and 15,519 during weekends.[1] The central circle is the major traffic node, thus, congestion always happens there (figure 4.15).

[1] Liu An. *Traffic Development Strategy of Wujiaochang*. Urban Road and Bridge，2000 (4).

In order to guarantee the continuity of vehicles, pedestrians are not allowed to cross the roads at ground level. Therefore, people have to walk downstairs to cross the roads. There are traffic lights at some major intersections near the central circle, and pedestrians have to wait for a considerable time in order to cross the road (figure 4.16). While in small intersections where there are no traffic lights, the conflict between cars and pedestrians is fierce. (Figure 4.17).

Figure 4.15

The pedestrian system at the ground level is interrupted by vehicles, and buildings contribute little to pedestrians. Therefore, if people want to reach the shopping mall on the other side of the road, they have to go back to the central circle or walk towards the other end of the road for intersection. Thus, greatly increasing the walking distance. For example, if you are at the bus stop on Wanda Plaza side, and want to reach the bus stop on the other side of the road, you have to walk 220 meters to the central circle and walk another 220 meters to get to the bus stop. Or you could walk 150 meters to the north intersection, waiting for 1 minute and 30 seconds to cross the road. And walk another 150 meters to get to it (figure 4.18). Thus, buildings as main attractions do not work as transfer nodes in pedestrian

Figure 4.16

Figure 4.17

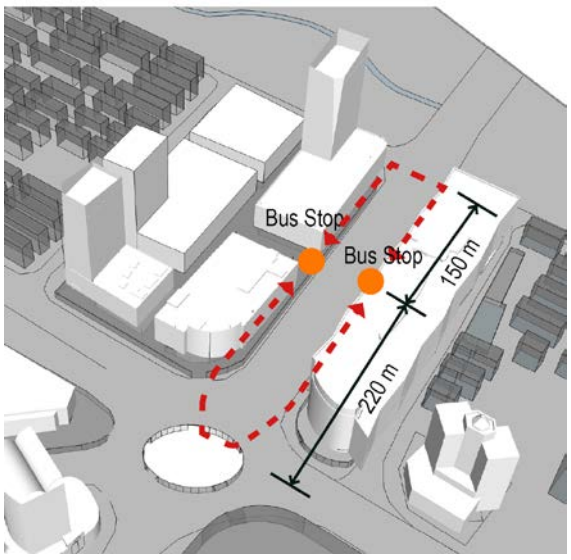


Figure 4.18

systems.

(2) Underground level

The underground pedestrian system is relatively complete, connecting with shopping malls in five directions as well as one metro station. It separates the pedestrians and vehicles, greatly supporting the safety, convenience and accessibility of walking. And it makes up for the disadvantage of the pedestrian system at ground level.

However, the underground pedestrian system does not cover a large area, being limited in the central area. Therefore, some experts propose that in the future, the entire Wujiaochang should be connected via underground walkways (figure 4.19).[1]

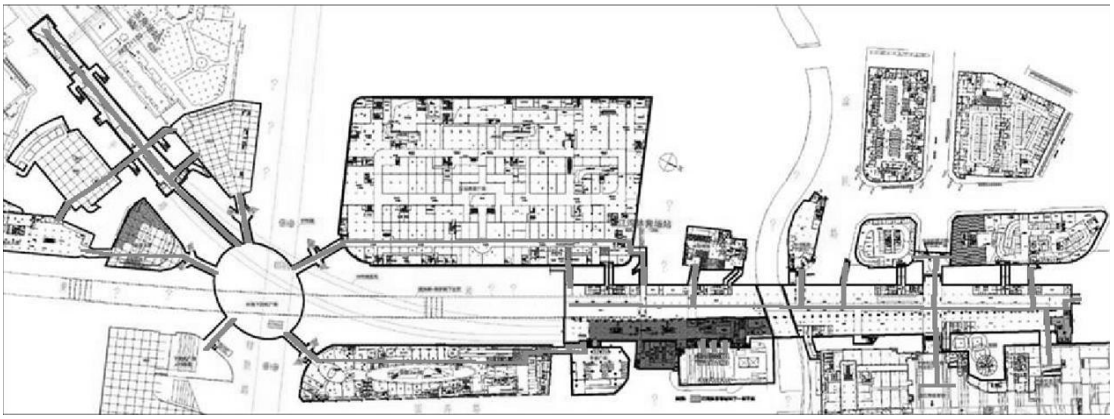


Figure 4.19

4.1.3.2 Integration Degree between Pedestrian Space and Buildings

(1) Ground level (figure 4.14)

At the ground level of Wanda Plaza (figure 4.20), five small volume buildings form a dynamic commercial area. One main street, two secondary streets and a plaza make up the main exterior public space. The first floors of buildings all open to walkways. The boundary between buildings and pedestrians is reduced by

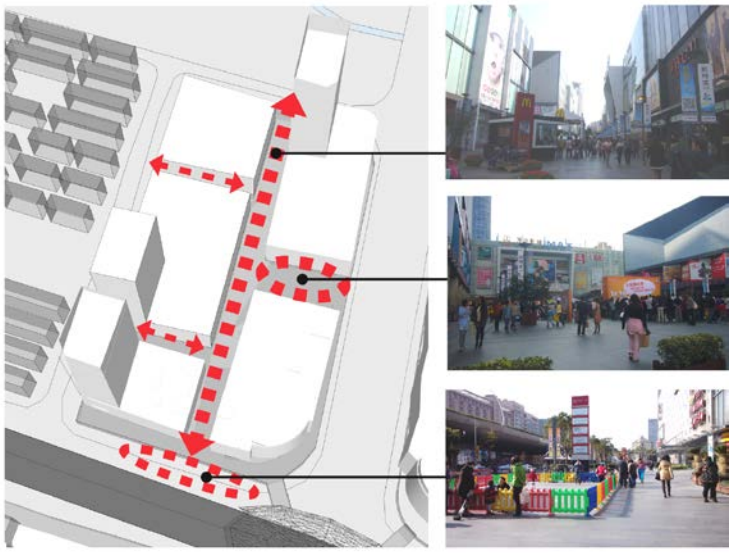


Figure 4.20

[1] Xu Fangchen, Dong Piling. *Design of Underground Space Exploitation in Jiangwan-wujiaochang Subcenter*. Chinese Journal of Underground Space and Engineering, 2006(7)

people going in and out. What is more, there are escalators connecting the ground floor and the underground floor, which fuses spaces of two levels. On the south of the area, the sidewalk is around 30 meters wide, which is enough for assorted activities. During daytime, this area becomes an exterior classroom for children to learn roller skating. During night, many people practice dancing here. Wanda Plaza is literally the most dynamic area in Wujiaochang.

Figure 4.21

The main street, two secondary streets and a plaza can be regarded as the transition space between buildings and main urban pedestrian walkways. This kind of space matches with (2) I mentioned in Assessment Methodology. What is more, the first floors around the plaza are partially open (figure 4.21), which is similar to the General Post Office of Hong Kong (figure 2.15). And as there are benches in the unenclosed spaces, people are willing to spend time there. Thus, it brings more potential business to the buildings.

Bailian is a huge mass which occupies the whole site. Although these is a metro station next to its north side, and there are several fast food shops on its west façade (figure 4.22), still few people spend time there. The same situation happens at the east side of Bailian. The 230-meter long edge only has two entrances, and the narrow sidewalk is divided in two by bicycle parking (figure 4.23). However, the situation is quite different at the other side of the street. With two-story small food shops sitting along the street, it is a popular place among residents and office workers nearby.

Figure 4.22

Figure 4.23

Other shopping malls, such as the Oriental Department Store and Suning Appliance occupy the whole site with a big mass (figure 4.24). Walkways and buildings are separated by heavy walls of buildings, reducing the relationship between buildings and pedestrians. Although the sidewalk is wide, still no one is willing to stop. The open space is wasted and becomes boring.

Figure 4.24

(2) Underground level

Buildings and walkways have a direct connection with each other. 5 underground corridors connect the central circle (the underground plaza) with 5 shopping malls in 5 directions.

The walkway connects with the interior underground commercial street within Wanda Plaza (figure 4.25). With a variety of shops setting along the street, the relationship between buildings and walkways at the underground level is similar to the ones at ground level. The pedestrian system successfully extends into the building.

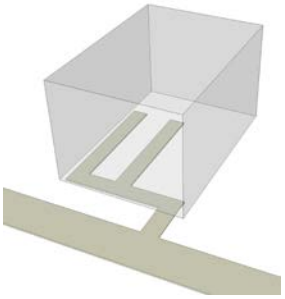


Figure 4.25

The walkway connects with the interior atrium within Bailian (figure 4.26). And also, the walkway extends across the entire building, connecting with a metro station on the other side of the building. In other words, with the help of the walkway, Bailian connects 2 metro stations, which is similar to the Skywalk in Bangkok.

The walkway connects with the enlarged interior space of the Oriental Department Store (figure 4.27), which is similar to the way Skywalk connects with the second floor of MBK (figure 2.33).

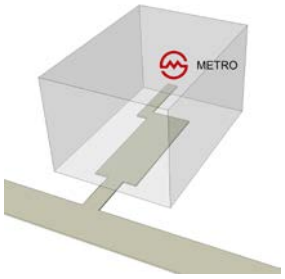


Figure 4.26

The walkway connects with the interior underground commercial street within Suning, and also connects with a metro station (figure 4.28). The building, public transportation, and underground plaza are closely connected with each other, which makes great use of the underground space, and increases the efficiency of walking.

Although it is quite convenient to reach buildings through these underground corridors, the corridors only work as a circulation area. If they were designed as an important transition space between buildings and underground plaza, with more functional support for pedestrians, the quality of the entire space would get a higher level.

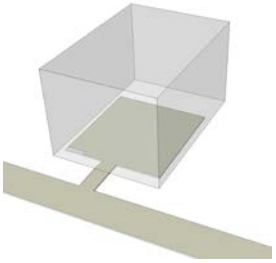


Figure 4.27

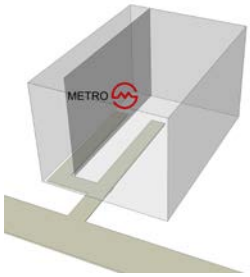


Figure 4.28

4.1.3.3 Functional Support for Pedestrian Systems by Buildings

Ashihara Yoshinobu proposed an idea in *Exterior Design in Architecture* about positive space. He thinks that “positive space meets the needs of people, and space should have multiple-functions. People in positive space should feel like being the master of the space. Therefore such kinds of space could be called humanized space.” [1]

The ground level of Wanda Plaza is a positive space relating back to the idea of

[1] Ashihara Yoshinobu. *Exterior Design in Architecture*. China Architecture & Building Press, 1985

Ashihara Yoshinobu. The space has a clear boundary which is made by several buildings. And there are various functions inside the area, which are closely related to our daily life such as retail, food shops and bookstores. The shops increase the interaction between pedestrians and buildings, enhancing the relationship between pedestrian systems and buildings. Meanwhile, the small volume buildings form several short walkways, which offer people more choices, stimulating the diversity of walking. As Jane Jacobs mentioned in *the Death and Life of Great American Cities*[1], short streets are very valuable.

Besides the multi-function in buildings, diverse functions in walkways are also important. Multi-function interiors and exteriors could greatly fuse two kinds of spaces. Taking Wanda Plaza as an example, there are ice cream shops, drink shops and exhibition facilities in the middle of the walkway (figure 4.29).

Figure 4.29

However in Bailian with the Oriental Department Store and Suning Appliance, despite their internal functions being diverse, they contribute far less to pedestrians. Because of the heavy solid ways, buildings and sidewalks are isolated.

Figure 4.30

Functional diversity also includes the integration of buildings with transportation nodes. In Wujiaochang area, underground floors of Suning Appliance and Bailian connect with one metro station each (figure 4.30), which shows the important role of buildings in pedestrian systems. While there still remains one problem in the Sunning case. With a pathway going directly to the metro station, many people are not willing to walk into the pathway crossing the building (which also leads to the metro station).

Except for two metro station exits inside Suning Appliance and Bailian, other exits are just on the sidewalk, unrelated with buildings, and with only a single function. What is more, bus stops and metro stations are separated (figure 4.11). Therefore buildings do not work as transfer nodes to support the convenience and efficiency of walking.

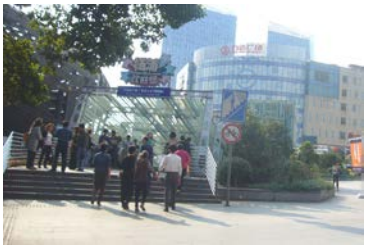


Figure 4.31

4.1.3.4 Comfort Level and the Sense of Place

(1) Accessibility facilities

The accessible facilities between underground plazas and ground level are not that complete. Although

[1] Jane Jacobs. *The Death and Life of Great American Cities*. Jin Hengshan Translated. Yilin Press, 2006

escalators connect the two levels, several steps at ground level still bring inconvenience to the handicapped (figure 4.31). And it is quite complicated to use the elevator; you have to contact the workers first, and then wait for them to come and operate it.

Figure 4.32

However, the accessibility features between buildings and pedestrian systems at ground level are well thought out. There are ramps at each entrance of buildings. However, the facilities between buildings and pedestrian systems at underground level are not well designed. Twelve stairs sit between the walkway and Wanda Plaza at the underground level, without a ramp nearby. And other connection areas in my site also show the lack of accessibility facilities (figure 4.32, figure 4.33).

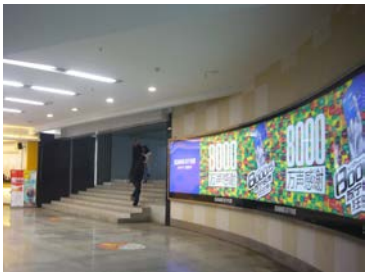


Figure 4.33

(2) Shading devices

The weather in Shanghai belongs to north subtropical monsoon climate, with a lot of sunshine and rainfall. Spring and autumn are short while winter and summer are long. It rains a lot during the summer, so shading devices are very important.

Figure 4.34

Although the outdoor space of Wanda Plaza is well designed and is very popular, there are not enough shading devices. The space under the overhanging eaves is always interrupted by columns (figure 4.34).

Figure 4.35

The shading devices along Bailian are continuous (figure 4.35), fully meeting the needs of pedestrians.

However, the Oriental Department Store and Suning Appliance don’t have a close relationship with walkways. And there are no shading device along the two buildings, which isolate pedestrians and buildings even more (figure 4.36).

Figure 4.36

(3) Benches

The need for benches is quite high in Wujiaochang. In Wanda Plaza, benches are integrated with landscapes, which increase the amount of benches (figure 4.37). This is popular to the point that during the days with nice weather, it can be hard to find a seat.

Figure 4.37

Despite having a lot of benches at the west side, Bailian still cannot attract many people to stay there because of lack of different functions. On the contrary, with no benches at the west side of Bailian, a lot of people are willing to spend time there. Therefore the fences are repurposed to benches by people (figure 4.38). There are some problems in arranging the benches.

Figure 4.38

(4) Traffic signs

Since the central circle has a lack of legibility by nature, traffic signs are far more important here than anywhere else. The traffic signs at the underground level are clear and obvious. Five corridors, each with a number, reduce the difficulty of recognition (figure 4.39). What is more, at each exit leading to the ground level, there shows the number of buses in that area (figure 4.40). However, to those who are not familiar with the bus numbers in this area, these numbers are meaningless.

Figure 4.39

Figure 4.40

(5) Landscape and green space

There are many kinds of landscape in Wujiaochang, especially the area along traffic roads and within underground plazas (figure 4.41). And there are some small landscapes along buildings, which

Figure 4.41

(6) Paving

Since Wujiaochang has been utilized for less than 8 years, the facilities are still new and nice. The clean and flat paving provides a nice walking environment.

(7) Legibility

The overall legibility in Wujiaochang is weak (figure 4.42). The appearance of the 5 corridors is almost the same, with many advertisements posted along the wall. Thus it makes the corridors more boring and too similar to each other.

Figure 4.42

Although the traffic signs do help a lot, there are still some people asking for directions during the time I was doing research. If each corridor were painted with a different color, they would be more distinguishable.

(8) Activities

In Wanda Plaza, the desirable walking area, multiple functions are supported by buildings successfully stimulating activities held by the public. As I mentioned before, during daytime, the wide walkway in Wanda Plaza is an exterior classroom for children to learn roller skating. During night, many people practice dancing here. The space is full of energy.

4.1.4 Conclusion

(1) Assessment on the Continuity of Pedestrian Behavior supported by Buildings

The pedestrian system at the ground level is always interrupted by vehicles. Buildings do not act as nodes to support walking. While on the underground level, pedestrian systems are relatively happy. It connects to shopping malls in five directions and one metro station. But it is limited, and has not become a big walking network.

(2) Assessment on the Integration Degree between Pedestrian Space and Buildings

At the underground level, the connection between buildings and the pedestrian system is straightforward. There are a variety of ways to use the connections:

a. Pedestrian system connects with the commercial street inside the building (figure4.25);

b. Pedestrian system connects with the atrium inside the building, and extends to the metro station which sits at the other side of the building (figure4.26);

c. Pedestrian system connects with open space inside the building (figure4.27);

d. Pedestrian system connects with the commercial street as well as metro station inside the building (figure4.28);

Although there are transit spaces between buildings and the pedestrian system, all transit spaces are inside buildings, which cause a single function (circulation only) of five corridors.

At ground level, Wanda Plaza is the most active space in Wujiaochang. I believe that it will not be so successful without the following 4 points:

a. The first floor of Buildings along both side of the pedestrian system all open to the pedestrian space. Buildings not only define the space, but also have the function of gathering consumers.

b. The boundary between building space and pedestrian space is reduced. People are able to walk through buildings, which enhances the relationship between buildings and pedestrian space.

c. As to the form, some building space integrates with pedestrian space (figure 4.20)

d. The major commercial street, plaza and the walkway on the south of Wanda Plaza work as transition nodes, providing wonderful spaces for activities.

However, other shopping malls, such as Bailian, Oriental Department Store and Suning Appliance are all “introverted” buildings, lack of openness. Although there are big square outside the buildings, few people are willing to stay.

(3) Assessment on the Functional Support for Pedestrian Systems by Buildings

Only Suning Appliance and Bailian connect with the metro stations (Wujiaochang Station and Jiangwan Stadium Station). But still some problems remain. For example, the passageway within Suning Appliance has not integrated with building space, with a circulating function only.

What is more, the metro stations are far away from bus stops, and buildings have not worked as transit nodes, contributing nothing to pedestrian systems.

However, walking space in Wanda Plaza is very nice. A variety of shops are embedded in the first floor of buildings. And the functions of the shops are closely related to our daily life, such as food shops, convenience stores and bookstores.

(4) Assessment on the Comfort Level and the Sense of Place

a. The accessible facilities at ground level are complete; while there seems to be a shortage of accessible facilities between buildings and walkways underground. And there are not enough accessible facilities between walkways on the ground and underground plaza:

b. Not enough shading devices;

c. Not enough benches;

d. Clear traffic signs;

e. Some green space;

f. Nice paving;

g. Weak legibility of the underground plaza (circle);

h. Activities hold by the public only appears in Wanda Plaza;

(5) Assessment on Sustainability

Collecting the responses of owners in order to improve the building is an important step in sustainability. If the way that people use the building is opposed to the design intent, an adjustment is required. For example, there is a wide walkway on the west of Bailian, with benches and trees, but few people sit there. On the contrary, on the south of Bailian, there is a big plaza with no sitting facilities. And at the boundary of the plaza, numerous people sit there, transforming the fence around the green space into benches. Such a situation should garner attention and be adjusted in order to make building environment serve a better urban life.

4.2 Study on the Symbiotic Relationship between Pedestrian Systems and Buildings in Lujiazui, Pudong District

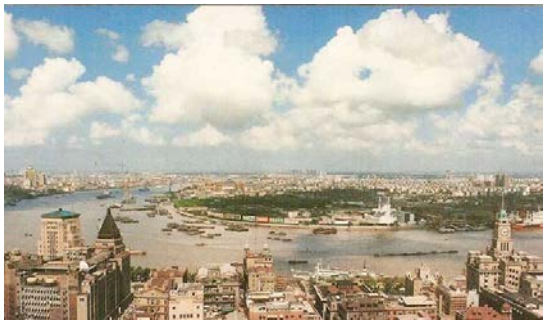


Figure 4.43 Lujiazui in 1990

Figure 4.44 Lujiazui Nowadays

Located in Pudong district, Lujiazui is one of the main financial centers of China (figure 4.44). The whole financial area is 28 square kilometers, with 100 towers completed.[1] The average density of Pudong district is 4275/km^2,[2] while the density of Lujiazui is 10687/km^2.[3]

4.2.1 Construction Process of Lujiazui

Before 1990, the construction focused on the west part of Shanghai. Therefore Pudong, the east part of Shanghai was left to undergo a more natural evolution (figure 4.43). In 1990, the Chinese government announced plans to develop Pudong area, setting up the first national financial development zone of China. In 1992, an international design competition was held, with famous architects such as Toyo Ito, Pursault, Rogers and Faksus. In December 1993, the final scheme was published. In 1994, the Oriental Pearl Tower was completed. After 1999, numerous high-rise buildings were finished. For example, the 420.5m Jin Mao Tower was finished in 1999, and the 492m Shanghai World Financial Center was completed in 2008. From 2007 to now, the problems existing in Lujiazui have become increasingly serious, with examples such as a lack of public space, huge building scale, isolated buildings and the domination of vehicles. After that, several solutions were made, such as adding retail to stimulate the dynamic growth of the area, and setting elevated pedestrian system to reduce the confliction between pedestrians and vehicles.[4]

[1] Lujiazui Commercial Center. http://www.china.com.cn/photochina/2012-05/07/content_25321460.htm. Last modified, 2012/05/07.
[2] "Shanghai Statistics Yearbook 2012". http://www.stats-sh.gov.cn/tjnj/nj12.htm?d1=2012tjnj/C0202.htm
[3] http://news.sina.com.cn/e/2005-01-11/14534790563s.shtml. Last modified, 2005/01/11.
[4] Liu Xiaoxing, Chen Yi. *From State Perspective to Everyday Life Perspective-A Research on Urban Spatial Transformation of Lujiazui Central Area.* Urban Planning Forum, 2012(3)

4.2.2 Range of Research and Current Situation

(1) Research area (figure 4.45)

The research area mainly covers the elevated pedestrian system (showed in blue). I focus on the relationship between elevated walkways and buildings.

Figure 4.45

(2) Current situation

a. Function (figure 4.46)

The area is mainly for working and shopping, and several tourist attractions attract huge amount of tourists every day. Therefore the area is quite festive during daytime, but lonely in night.

Figure 4.46

Figure 4.47

b. Transportation node (figure 4.47)

The metro station of Line 2 sits at the heart of Lujiazui. Besides, 3 bus stops (around 10 buses) sit along the elevated walkway. With the metro station as the center, there are 30 bus stops within the radius of 500m.

c. Attractive places (figure 4.48)

As one of the most famous tourist attractions in Shanghai, the Oriental Pearl Tower, Jin Mao Tower and Shanghai World Financial Center attract a huge amount of people every day. Besides tourists, another big group is office workers, which occupies more than 60% of the whole population in Lujiazui. It is reported by Jones Lang LaSalle that with more office buildings put into use, the traffic load of the metro would increase dramatically. The population who take the metro to work would reach 120,000 up to 2014.[1]

[1] http://cq.focus.cn/news/2011-08-31/1461325.html. Last modified, 2011/08/31.

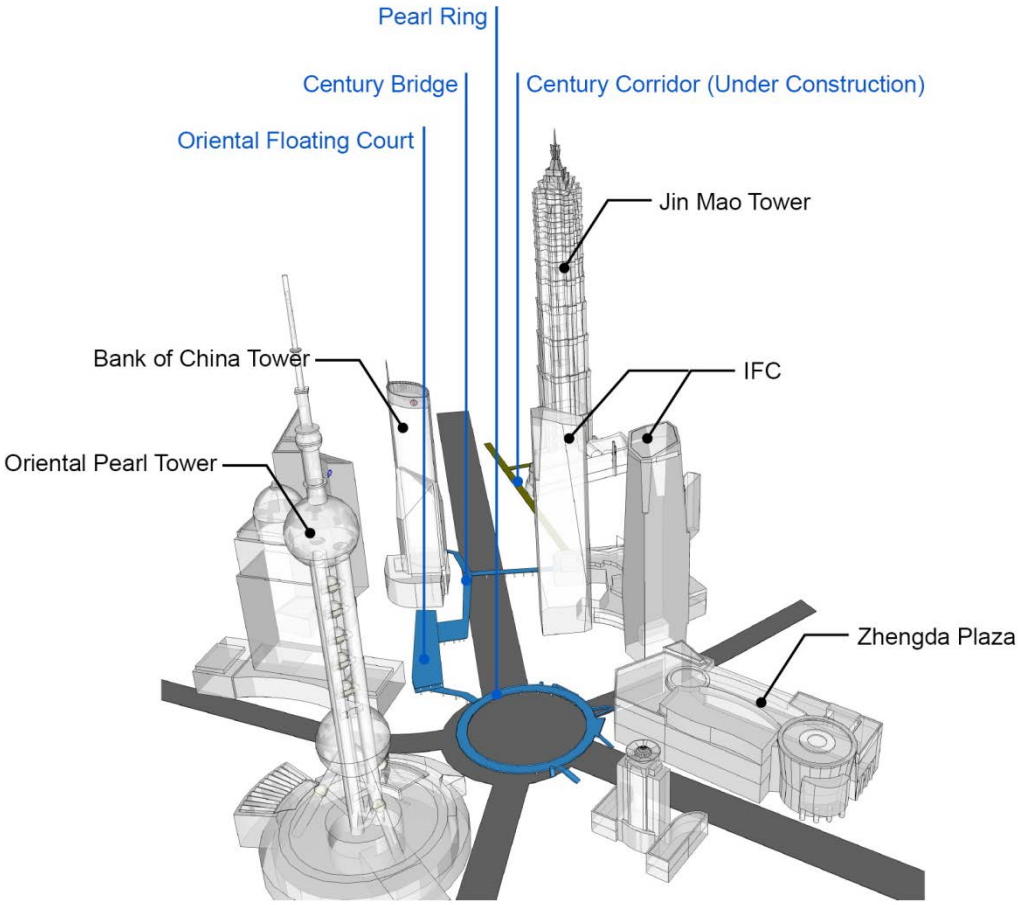


Figure 4.48

4.2.3 Analysis of the Symbiotic Relationship between Pedestrian Systems and Buildings

4.2.3.1 Continuity of Pedestrian Behavior supported by Buildings (figure 4.49)

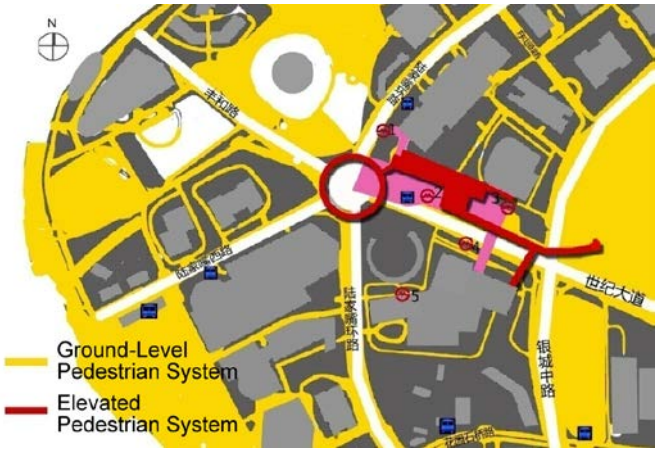


Figure 4.49

Within the research area, the pedestrian system at the ground level is interrupted by wide traffic roads. Although the entire width of sidewalks along Century Avenue (100m wide) is 69m, with northern part 44.5m and southern part 24.5m[1], most parts of the sidewalk lack anything dynamic. There are several reasons for the problem. For example, there is not enough retail along the sidewalk; also the vast walking space and huge buildings greatly reduce the comfort level of the sidewalk. Finally, the wide traffic road separate two sides of the road (figure 4.50).

Figure 4.50

In order to provide a safe and convenient walking space for pedestrians, the elevated pedestrian system is now under construction. It is made up by Oriental Floating Court, Century Bridge, Pearl Ring and Century Corridor (under construction).

Pearl Ring (figure 4.51, 4.52) located next to the Oriental Pearl Tower, crossing one of the busiest intersections in Lujiazui. The perimeter of Pearl Ring is 370m, with the height of 7.9m and width of 8.5m.[2] Stairs, elevators and escalators are set at 5 places around the Pearl Ring. The Pearl Ring connects the Oriental Pearl Tower, Zhengda Plaza, IFC, Bank of China Tower and Oriental Floating Court (with one metro station inside), which works for circulation as well as sightseeing.

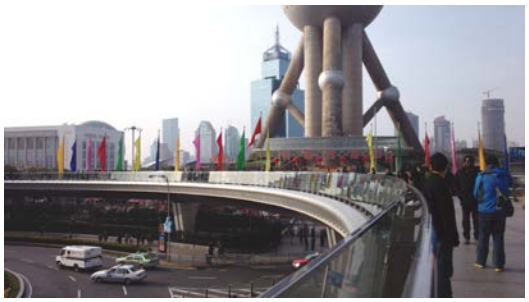


Figure 4.51

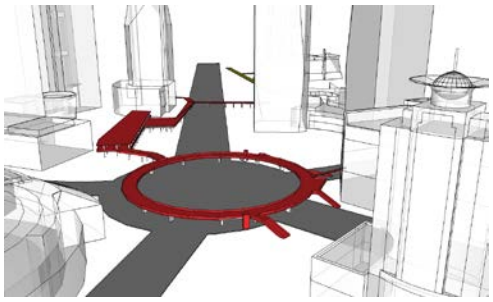


Figure 4.52

Oriental Floating Court (figure 4.53, 4.54) is two-floor building, with the functions of entertainment, shopping and circulation. It is the transfer node of bus stops at ground level, metro station at underground level, and it directly connects with the elevated pedestrian system. After getting out of the metro, peopled can reach the elevated walkway and get to the Oriental Pearl Tower or Jin Mao Tower without going back to ground level.

With a length of 102m and width of 8m[3], Century Bridge (figure 4.55, 4.56)

[1] Sun Liang. *Transportation, Landscape and Human*. Huazhong Architecture, 2006 (12).
[2] http://news.sina.com.cn/o/2010-01-07/132916894465s.shtml. Last modified: 2010/01/07.
[3] "Century Bridge". Last modified 24 April 2011, http://news.sina.com.cn/o/2011-04-24/040822347370.shtml

connects IFC and Oriental Floating Court, offers pedestrians a safer way to cross the road.

Figure 4.53

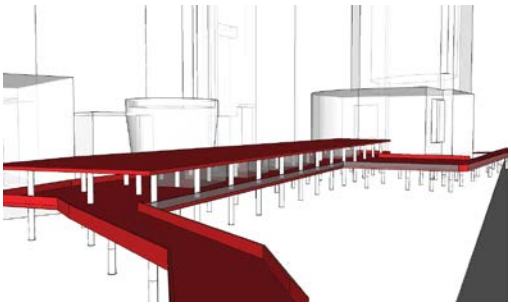


Figure 4.54

Figure 4.55

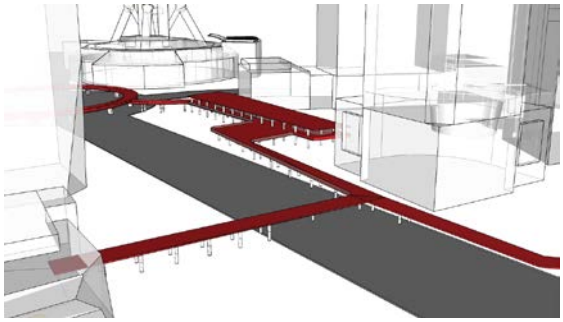


Figure 4.56

The elevated pedestrian system greatly reduces the competition between pedestrians and vehicles. And the nice walking environment attracts many people, whether they be tourists or locals. Thanks to the elevated walkway, it only takes 7 to 8 minutes to walk from the Oriental Pearl Tower to Jin Mao Tower.

Besides the elevated pedestrian system, the government is planning a huge underground pedestrian system in Lujiazui. Once it is completed, numerous buildings, landmarks, and metro Lines 2 and 14 would be connected together, providing a great convenience to office workers.

4.2.3.2 Integration Degree between Pedestrian Space and Buildings

I focused on the buildings along the elevated pedestrian system, in order to study their relationship with pedestrian systems at elevated and ground level.

Figure 4.57

(1) Elevated level

Start from east to west, the first building connecting with Century Bridge is IFC (figure 4.57). The elevated walkway connects directly with the interior corridor of IFC with no height difference. But from the point of design, there is no transition space between interior and exterior. The space seems a

little bit stiff (figure 4.58).

Walking towards the west on the elevated walkway, you would meet with another building called Oriental Floating Court. A series of grey space with columns connects the building and walkway (figure 4.59). Thus, the boundary between the building and pedestrian system is turned down. What is more, Oriental Floating Court works as transfer nodes, connecting underground, ground, and elevated level. And also, it connects 2 portions of the elevated walkway, fusing with pedestrian system. There is an elevated plaza at the connection

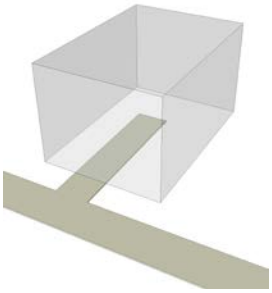


Figure 4.58

Figure 4.59

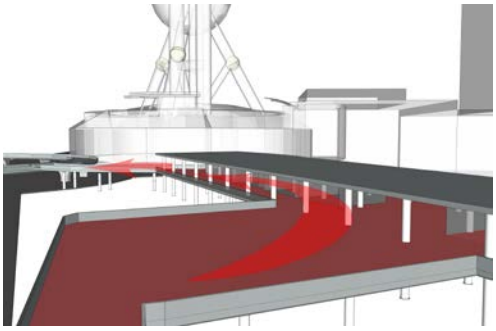


Figure 4.60

area between the building and walkway (figure 4.60), with benches, shading devices.

The connection area between the Pearl Ring and Zhengda Plaza is not smooth enough. The height difference is solved by stairs and escalators (figure 4.61, 4.62). And the connection area inside the building is boring (figure 4.63).

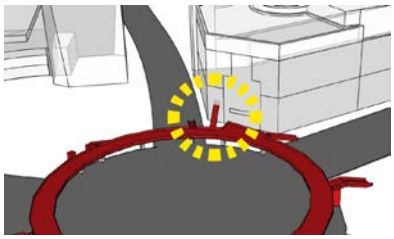


Figure 4.61

Figure 4.62

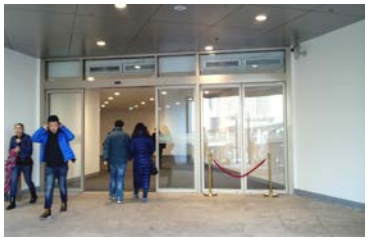


Figure 4.63

(2) Ground level

At the south side of Century Avenue, since the sidewalk is wide enough, it is divided into two parts, one next to the building and one next to traffic. They are separated by a small traffic road (for cars going into the building) and a green bar (figure 4.64). It clarifies the difference between shoppers and people who pass by, which, to a certain extent, reduces the dynamics of the street. Besides two entrances, the first floor of IFC is isolated to sidewalk by solid walls. However, the secondary entrance

Figure 4.64

of IFC is well designed. The underground plaza in front of the entrance is a wonderful gathering place (with benches), which absorb numerous people walking into the building. And it is also a transition space between buildings and pedestrian systems (figure 4.65).

Figure 4.65

The way that the ground level of Oriental Floating Court connects with walkway is the same with the one at elevated level.

Zhengda Plaza is an “introverted” building, with solid walls and showcases facing to the sidewalk. One side of Zhengda Plaza has a parterre along its wall, and the width of the parterre is wider than sidewalk, which makes the walking space narrow (figure 4.66). In another side of Zhengda Plaza, landscape divides the sidewalk into two parts. And there is a 10-step height difference between the two parts, which reduces the relationship between the building and pedestrian system (figure 4.67).

Figure 4.66

Figure 4.67

4.2.3.3 Functional Support for Pedestrian Systems by Buildings

The functions in the research area are mainly shopping and sightseeing. Commercial buildings, such as Zhengda Plaza and IFC are “introverted” buildings, with various interior functions, but a few open towards the walkways.

Figure 4.68

Oriental Floating Court is an “extroverted” building (figure 4.68), the multi-function of the building could be seen from walkways. And these functions are close to our daily life, such as small restaurants, retail, and drink shops. The area is popular among office workers nearby. Since it is the transfer node between buses and metro, a huge amount of people congregate here, which brings out more of the dynamics of the area.

Although there are numerous office buildings in Lujiazui, the public accessibility of them is difficult. The service function inside buildings cannot serve the pedestrians outside.

4.2.3.4 Comfort Level and the Sense of Place

(1) Accessibility facilities

Lujiazui has three-level pedestrian systems, therefore the accessibility of facilities is very important. There are complete accessibility facilities between each level of walkways and IFC, Oriental Floating Court and Zhengda Plaza. And between each level of the walkway, there are escalators and elevators. While there are 3 steps after the escalator, which brings an inconvenience to the handicapped (figure 4.69).

Figure 4.69

(2) Shading devices

At ground level, there are Shading devices along some parts of IFC, but they are not continuous. The shading devices along Zhengda Plaza only cover the landscape portion, still leaving the walkway exposed to sunshine and rain. Oriental Floating Court has great shading devices because of its grey space.

Figure 4.70

At the elevated level, half of the Century Bridge is covered (figure 4.70), which offers alternative options for pedestrians. There is no shading device above the Pearl Ring (figure 4.71), which I think is reasonable, since shading device would affect the view towards many landmarks.

Figure 4.71

(3) Benches

Although with huge amount of people, the research area lack of benches. Only Oriental Floating Court and IFC have some benches in the elevated and underground plaza, which makes the pedestrian situation even more unfriendly than in Lujiazui.

(4) Traffic signs

As one of the most important tourist attractions, the traffic signs in Lujiazui are clear and quite straight forward.

(5) Landscape and green space

There are a variety of landscapes in Lujiazui (figure 4.72). And there is a 100,000m^2 park in the east of my research area, which reduces the pressure in concrete buildings. But the park is not popular at all; it is like a peaceful exhibit lying in the center of noisy urban core.

Figure 4.72

(6) Paving

The paving in research area is nice and clean, especially at elevated level (The elevated pedestrian system has been in use for less than 3 years).

(7) Legibility

Since the main pedestrian system is above ground and there are several landmarks around the walkway, the legibility in Lujiazui is good enough.

4.2.4 Conclusion

(1) Assessment on the Continuity of Pedestrian Behavior supported by Buildings

There are three levels of pedestrian system in the research area. Among them, the elevated pedestrian system offers pedestrians great convenience and a desirable walking environment, which makes up the discontinuous pedestrian system at the ground level. However, since the limitation (coverage area) of elevated pedestrian system, walking behavior is interrupted by wide traffic roads after pedestrians get down to the ground level.

Buildings do not contribute much at the horizontal level, except Oriental Floating Court connecting Pearl Ring and Century Bridge (figure 4.48). Shanghai IFC and Super Brand Mall both simply connect with the elevated pedestrian system, do not work as transfer nodes. Thus, buildings and pedestrian systems have not form a big network, and there are not many choices of walkways.

As to vertical aspect, buildings successfully connect underground, ground and elevated pedestrian systems. Pedestrians are able to arrive at different levels of walkways through buildings, which reflect the contribution of buildings in terms of supporting the continuity of walking behavior.

(2) Assessment on the Integration Degree between Pedestrian Space and Buildings

Since the elevated walkway was built after the construction of most surrounding buildings, they cannot integrate well with buildings. Till now, the elevated pedestrian system connects with three buildings only (Shanghai IFC, Super Brand Mall and Oriental Floating Court). Among them, the connection with Shanghai IFC and Super Brand Mall lack of transit space (figure4.58, 4.61). While Oriental Floating Court and elevated pedestrian system perfectly integrate with each other, since they were built at the same time. Numerous “functional boxes” of Oriental Floating Court are covered by a huge roof (figure 4.54), the open and flexible space erase the boundary of building and pedestrian system.

At the ground level, buildings are almost “introverted”, with heavy walls facing the walkways. And what is more, green belts between buildings and walkways separate pedestrians and buildings. However, the entrances of some buildings provide great transit space between buildings and walking space, such as the secondary entrance of Shanghai IFC (figure4.65).

(3) Assessment on the Functional Support for Pedestrian Systems by Buildings

Most buildings in the research area have relationship with metro stations, which

enhance the function of buildings as well as offer convenience to pedestrians. Diverse “functional boxes” of Oriental Floating Court greatly enrich the function of pedestrian systems, while other buildings are “introverted” and their diverse function interior cannot support walking behavior exterior.

(4) Assessment on the Comfort Level and the Sense of Place

a. Perfect accessibility facilities;

b. Enough shading devices on elevated pedestrian system; Lack of shading devices along buildings;

c. Not enough benches;

d. Clear traffic signs;

e. Some green space;

f. Nice paving;

g. Strong legibility;

(5) Assessment on Sustainability

Under the urban planning of the dominant of vehicles, huge scale spaces appear in Lujiazui, which is not friendly to daily life. Luckily, the government is taking action to remedy the problem, such as infill retail shops between huge buildings. Hopefully after more small buildings and diverse functions being filled in Lujiazui, the area will be more friendly to urban daily life.

Oriental Floating Court, Pearl Ring, Century Bridge and Century Corridor are new built projects, so there remain some problems in the connection with existing buildings. For example, the existing buildings have not left a connection point with the elevated pedestrian system during the design period, which caused the lack of transition space.

In addition, if the official buildings in Lujiazui could open one floor or several floors to the public, serving for pedestrian system, the area would be more dynamic and friendly.

4.3 Study on the Symbiotic Relationship between Pedestrian Systems and Buildings in Xujiahui, Xuhui District

Figure 4.73 Xujiahui before 1988

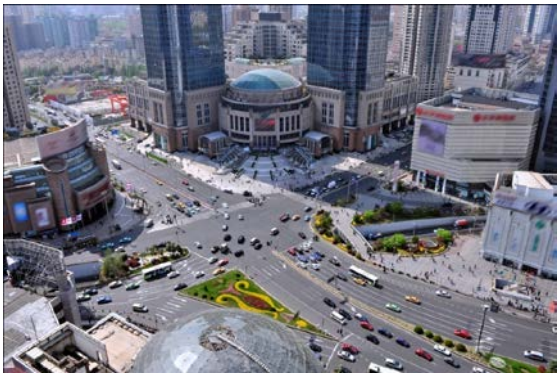


Figure 4.74 Xujiahui Nowadays

Xujiahui is located in the southwest of the center of Shanghai, and it is one of the four sub-centers of Shanghai, with the density of 19996/km^2.[1] With many shopping malls, Xujiahui attracts a large number of people daily. (Figure 4.73, 4.74)

4.3.1 Construction Process of Xujiahui

From 1949, houses and neighborhoods were torn down and replaced by factories. In 1988 the planning of Xujiahui was started. The first phase of construction started in 1992, with 10 projects (110,000m^2). The second phase of construction finished in 1997, including Grand Gateway, and Huijin Shopping. The third phase of construction was completed in 2000. Today, Xujiahui is a centre for commerce, business and public activities.[2]

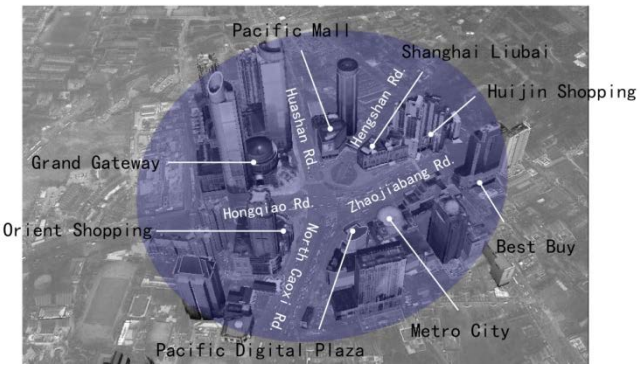


Figure 4.75

4.3.2 Range of Research and Current Situation

(1) Research area

The research area makes the intersection of 5 roads as the center, which is 800m is diameter (around a 10-minte walk). It is shown in figure 4.75 in blue.

(2) Current situation

[1] "Shanghai Statistics Yearbook 2012". http://www.stats-sh.gov.cn/tjnj/nj12.htm?d1=2012tjnj/C0202.htm

[2] "Shanghai local Chronicles". http://www.shtong.gov.cn/node2/node2245/node4482/node54724/node54735/node54788/userobject1ai41077.html

a. Function (figure 4.76)

The functions included in the research area are mainly commerce and office. And since the long history of Xujiahui, there are lots of historic buildings in this area, such as Xujiahui Catholic church and Xujiahui library.

Figure 4.76

b. Transportation node (figure 4.80)

As the transfer node of metro Line 1 (figure 4.77 in blue), Line 9 (figure 4.77 in red) and Line 11 (under construction), and together with more than 50 bus lines, Xujiahui attracts 800,000 people per day.[1] Compared with buses, the metro is more popular (figure 4.78). There are 18 exits in all, which connects several shopping malls and historic sites in the entire area.

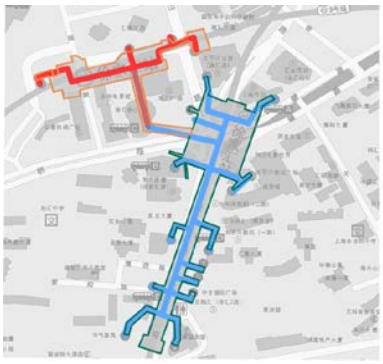


Figure 4.77

c. Attractive places

Shopping malls, historic buildings, neighborhoods and office buildings are the places people going. There are several shopping malls sitting around the 5-road intersection, which are Pacific Mall, Shanghai Liubai, Huijin Shopping, Best Buy, Metro City, Pacific Digital Plaza, Orient Shopping and Grand Gateway (figure 4.75). Therefore the most population are shoppers (figure 4.79).

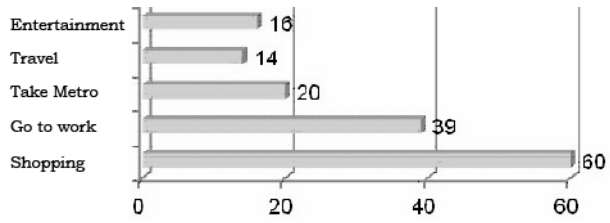


Figure 4.78

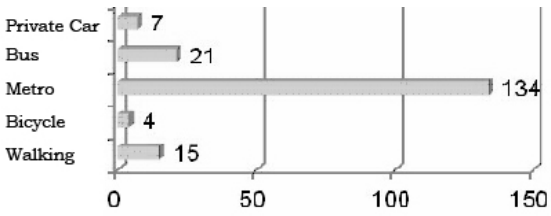


Figure 4.79

4.3.3 Analysis of the Symbiotic Relationship between Pedestrian Systems and Buildings

4.3.3.1 Continuity of Pedestrian Behavior supported by Buildings

[1] "Rapid development of Xujiahui". http://sydc.sh.soufun.com/2012-02-29/7153058.htm. Last modified: 2012/02/09

Chart 3.1 Study on Shanghai Xujiahui Core Area's Pedestrian System

Road	Road Grade	Number of Traffic lines	Width of Sidewalk （m）
Hongqiao Road	Main Road	8	4
Caoxi Road	Main Road	8	4
Huashan Road	Main Road	6	5
Zhaojiabang Road	Main Road	8	4

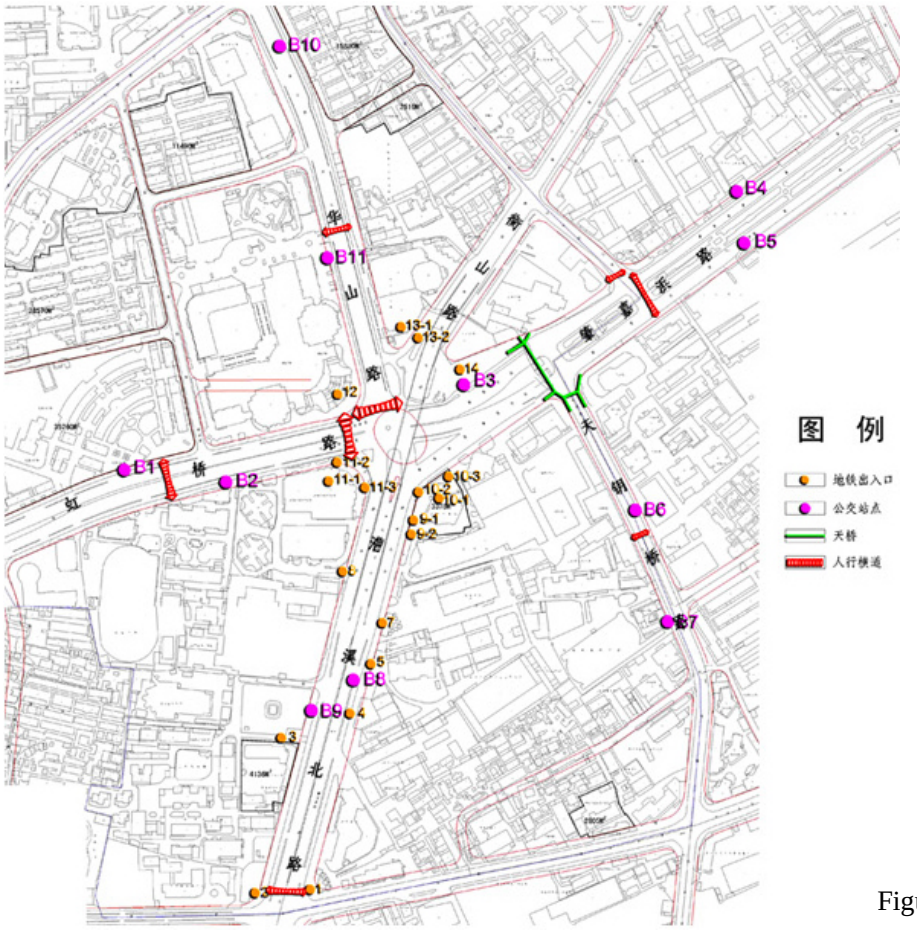


Figure 4.80

The width of the road is shown in chart 3.1. However, the sidewalks are transferred into parking, which greatly reduce the comfort level of walking space (figure 4.81).

Figure 4.81

At the intersection of the five roads, the wide lanes separate the buildings in 5 directions. And it is not convenient to cross such wide roads. What is more, there is no sidewalk on two of the roads. The pedestrian system at ground level is completely

interrupted (figure 4.80). Buildings contribute nothing to pedestrian system here.

However, the underground pedestrian system is a big feature in Xujiahui. 18 exits of metro Line 1 and Line 9 connect many shopping malls and historic buildings. Among them, exit 4, 12 and 13 connect directly with the interior space of Best Buy, Grand Gateway and Pacific Mall (figure 4.82).

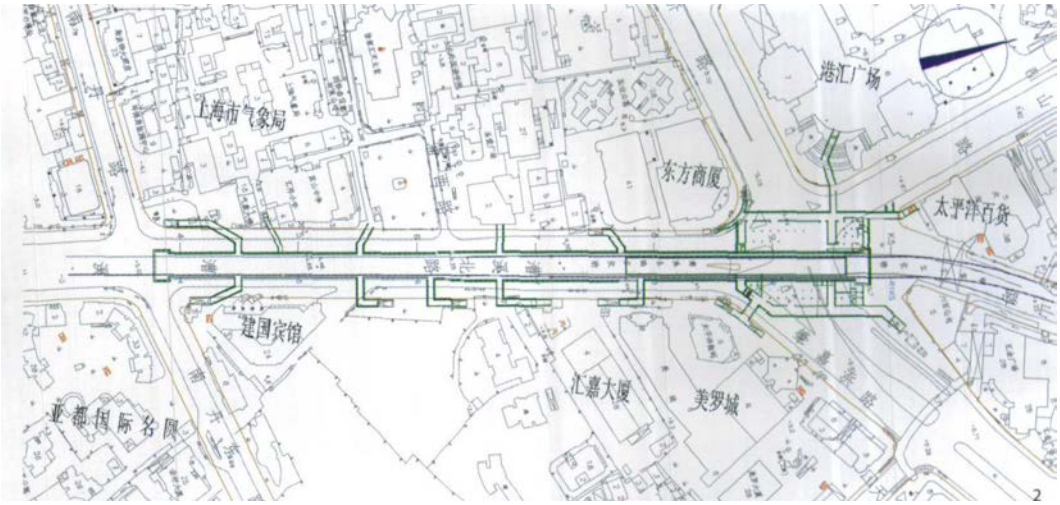


Figure 4.82

There are passenger foot-bridges over Zhaojiabang Road and Hengshan Road, connecting buildings on each side of the roads (figure 4.83). Buildings work as nodes, supporting the continuity of walking. But the foot-bridges only cover a few shopping malls, and have not formed a completely elevated pedestrian system.

Figure 4.83

4.3.3.2 Integration Degree between Pedestrian Space and Buildings

(1) Ground level

The 5 buildings around the intersection are all large masses, which occupy the entire area. And they don't have much openness towards the pedestrian systems, which reduce the relationship between walking space and buildings.

Figure 4.84

With only one entrance facing the walkway, Shanghai Liubai contributes least to pedestrian system. (Figure 4.84)

Having 39 stairs surround the building, the Grand Gateway tries to lead people to the entrance on the second floor. However, the purpose of the designer seems to be contrary to real use. Few people walk on the steps, instead, most of them take the escalators at the end of the stairs. And numerous people go into the building through the underground level (figure 4.85). Some parts of the stairs are decorated by

landscaping, so the big plaza in front of the building becomes a place for people to take photos, but little else. Most pedestrians just pass by the plaza, instead of spending time there or enjoy socializing. At the other side of the building, the exterior of the building envelope is separated from the sidewalk by a height difference (figure 4.86). Thus, the building is isolated to its surroundings.

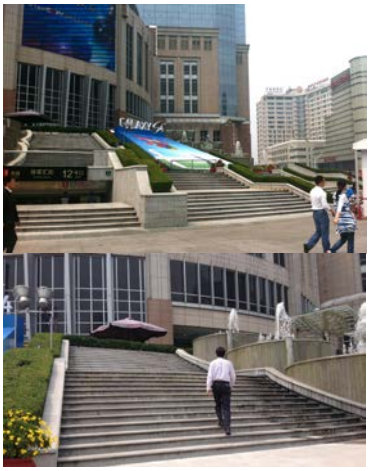


Figure 4.85

Having only three openings facing the sidewalk, the Orient Shopping faces the same situation. And the landscape, fences, and paving clarify the realm of the building even more.

Figure 4.86

However, on the other side of the road, although the sidewalk is divided into two parts, the building still attracts many people due to its great openness to the sidewalk (figure 4.87).

The Metro City has a close relationship with the pedestrian system. The overhang at the entrance covers the entire walking area. It becomes a great transition between walking space and interior space (figure 4.88).

Figure 4.87

(2) Underground level

Many exits of the metro stations connect with the underground floor of buildings. Among them, exit 12 connects with the Grand Gateway. The walking space is gradually enlarged from the metro area to the shopping mall area. And there are stairs and escalators sitting before the entrance of the building, which benefits pedestrians just passing by (figure 4.89).

Figure 4.88

However, the connection between Pacific Mall and the underground path is not well designed. The 10 square meters transition space hides behind the wall (figure 4.90).

Figure 4.89

(3) Elevated level

The foot-bridge crossing Hengshan Road connects Pacific Mall and Shanghai Liubai (figure 4.91). The bridge is not only for circulation, it is also an elevated shopping mall. Figure 4.92 shows the interior of the bridge. The space fuses with

building space. It is hard to notice that you already crossed a road of 4-lane traffic when walking across the foot-bridge. Thus, the continuity of walking and shopping are greatly supported by the foot-bridge.

Figure 4.90

4.3.3.3 Functional Support for Pedestrian Systems by Buildings

The space within research area cannot be regarded as positive space proposed by Ashihara Yoshinobu[1]. The 5 buildings around the intersection of the 5 roads are all "introverted" shopping malls, with multi-function interiors that are difficult to see from outside. The enclosed buildings cause single-functions to exist on the sidewalk. Contrarily, at the east side of Caoxi Road, numerous shops spread along the sidewalk, such as bread shops, fast food, or drink shops. The small scale buildings form several small plazas (figure 4.93), where many people are willing to spend time.

Figure 4.91

Figure 4.92

At the underground level, several main shopping malls connect with the exits of the metro stations. Figure 4.94 shows the integration of metro stations with the Grand Gateway[2]. The integration enhances the diversity of the building as well as the station.

Figure 4.93

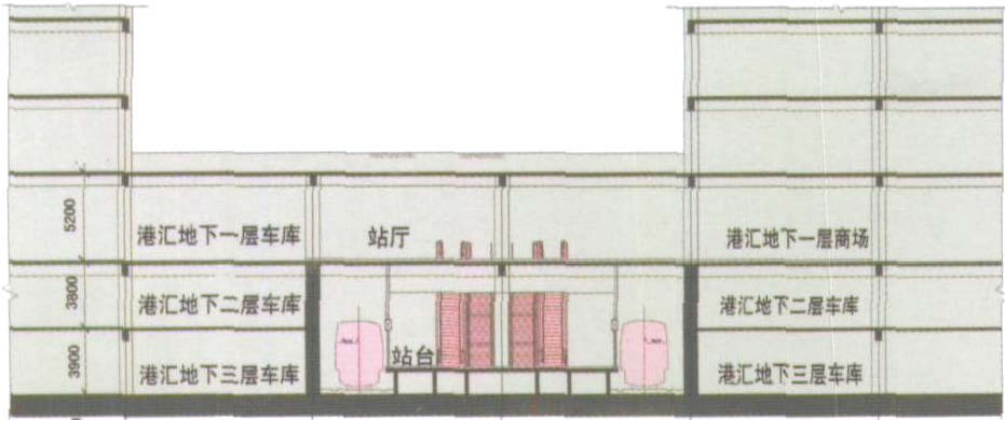


Figure 4.94

[1] Ashihara Yoshinobu. *Exterior Design in Architecture.* China Architecture & Building Press, 1985
[2] Xu Zhengliang, Chen Ye. *Integrated Development and Utilization of Xujiahui Hub of Shanghai Rail Transit and Its Underground Space.* Time Architecture, 2009(5)

4.3.3.4 Comfort Level and the Sense of Place

(1) Accessibility facilities

Since the underground pedestrian system is a big feature of the entire area, the connection between ground and underground level is far more important. Based on my research, almost half of the total 18 connection spaces have no escalator, such as exit 4, 11, 12, 13. However, these exits all connect with the underground level with buildings, so handicapped could go upstairs by using the elevators inside the buildings.

Figure 4.95

The accessibility facilities at ground level are not that complete. There is no ramp at the entrance of Huijin Shopping (figure 4.95). And the height difference between building realm and walkways brings a lot of inconvenience to pedestrians.

Figure 4.96

The escalator at the foot-bridge over Zhaojiabang Road only goes up. During my research, I rarely saw old people walking downstairs (figure 4.96). Moreover, the connection between the foot-bridge and buildings are stairs only, without escalator.

Figure 4.97

(2) Shading devices

The research area is short of shading devices, only with a 1 meter wide overhang around Shanghai Liubai (figure 4.97). The situation reduces the comfort level of walking.

Figure 4.98

(3) Benches

There are not enough benches in research area, especially the plaza in front of Grand Gateway (without benches at all). (Figure 4.98)

(4) Traffic signs

Traffic signs are quite clear in research area. The maps not only show the shopping mall and historic buildings, but also show the 10-minute walking radius (figure 4.99).

Figure 4.99

(5) Landscape and green space

Compared with the photo of Xujiahui in 1988 (figure 4.73), the lack of green space is another major problem in Xujiahui (figure 4.100). In order to make up the shortage of green space, there are landscapes along the sidewalk, and in the middle of the traffic road.

(6) Paving

Since the facilities in Xujiahui have been used for more than 13 year, some parts of the paving are damaged (figure 4.101 shows the situation on the foot-bridge over Zhaojiabang Road).

Figure 4.100

(7) Legibility

The legibility at underground level is weak, although the traffic signs are clear and understandable. The walkways underground are too long to recognize the actual location.

Figure 4.101

4.3.4 Conclusion

(1) Assessment on the Continuity of Pedestrian Behavior supported by Buildings

a. Pedestrian system on the ground is interrupted by vehicles, and buildings do not work as nodes;

b. Underground pedestrian system connect to metro stations and the first level below grade of buildings, and extend to several tourist attractions, which offer efficient walkways without the effect of weather.

c. Shanghai Liubai Shopping mall works as the connection node in the middle of two elevated walkways, contributing a lot to the continuity of elevated walking.

(2) Assessment on the Integration Degree between Pedestrian Space and Buildings

a. The relationship between buildings and pedestrian system on the ground is fairly weak. Buildings are “introverted”. Only the entrance of Metro City integrates with walking space by shape (figure4.88).

b. At the underground level, the integration of buildings with pedestrian system is uneven. The transition space in Grand Gateway is smooth (figure 4.89) while the transition space in Pacific Mall is stiff (figure 4.90).

c. At the elevated level, pedestrian system connects well with buildings. The foot-bridge beyond Hengshan road perfectly integrates with buildings.

(3) Assessment on the Functional Support for Pedestrian Systems by Buildings

The connection between metro stations and buildings is a feature in Xujiahui. After getting off the metro, people can get to ground level through buildings, which underlines buildings’ support of the pedestrian systems. However, the long walkway underground has the function of circulation only, the various functions within shopping malls do not extend to the underground walkways.

In addition, metro stations are far removed from bus stops (figure 4.80), buildings contribute nothing on the transfer nodes.

In the research area, most buildings are “introverted”, with mass wall facing walking space. Only at the east side of Caoxi North Road are there some small shops, which offer functional support for walking behavior.

(4) Assessment on the Comfort Level and the Sense of Place

a. Lack of accessibility facilities;

b. Not enough shading devices;

c. Lack of benches;

d. Clear traffic signs;

e. Some green space;

f. Poor paving;

g. Week legibility underground;

(5) Assessment on Sustainability

Pedestrian system is interrupted at the ground level; while underground pedestrian system is perfect but has a lack of legibility. Therefore, the government is planning a skywalk project, cooperating with at grade and underground pedestrian systems. A news story on Jan. 24, 2013 said that in the future, shopping malls in Xujiahui will be connected by sky bridges and gardens, in order to separate vehicles and pedestrians. And the elevated pedestrian system would extend to further areas, forming a large elevated network (figure 4.102).[1]

Figure 4.102

[1] “Elevated Xujiahui”. http://newspaper.jfdaily.com/xwcb/html/2013-01/24/content_962796.htm. Last modified: 2013/01/24

Chapter 5 Design Strategy on the Symbiotic Relationship between Pedestrian systems and Buildings

In the previous chapters, I gave a detailed analysis of the relationship between pedestrian systems and buildings in Hong Kong, Bangkok, Boston and Shanghai. Hong Kong has a perfect multi-level pedestrian system which connects closely with surrounding buildings. In Bangkok, the pedestrian system connects with Skytrain stations as well as buildings. The sky bridges in Boston integrate with buildings, providing a great elevated interior space. Although the three pedestrian systems in Shanghai are not as good as the ones in Hong Kong, Bangkok and Boston, they have their own unique features. For example, buildings in Wanda Plaza of Wujiaochang are highly open to the public. People can easily go into buildings and pass through, which reduces the sense of boundary between buildings and pedestrian streets. In Lujiazui, the Oriental Floating Court is the node connecting the underground, ground and elevated pedestrian systems, and also, it is the node connecting two parts of the elevated walkways. The big underground pedestrian system in Xujiahui is a great feature, which connects shopping malls and tourist attractions. In this chapter, I will summarize the five pedestrian systems above, discussing the advantages and disadvantages. And finally, I will propose the design concept and design strategy on the symbiotic relationship between pedestrian systems and buildings.

5.1 Learning from Hong Kong, Bangkok and Boston

(1) The elevated pedestrian systems and surrounding buildings in Hong Kong, Bangkok and Boston formed a big system. Buildings work as nodes, connecting each part of the walkways;

(2) There are a variety of ways that buildings and walking space connect with each other;

(3) Buildings integrate closely with metro stations, bus stops, Skytrain stations and metro stations;

(4) Buildings greatly open to the pedestrian systems, with multi-function shops set on the edge of buildings;

(5) Pedestrian systems have high comfort level, and the accessibility facilities and green space are complete;

(6) Activities are stimulated because of the wonderful environment;

(7) Pedestrian systems have a strong legibility;

(8) The governments fully support the connection between buildings and pedestrian

systems. There is a plot ratio or building area reward in Hong Kong; In Bangkok, the construction fee of Skywalk is assuaged by the Bangkok Transit System Corporation and nearby building owners.

5.2 Main Problems existing in Pedestrian systems and Buildings in Three City Centers of Shanghai

(1) The continuity of pedestrian behavior supported by buildings is not comprehensive. Buildings and pedestrian systems have not formed a cohesive network.

a. Wujiaochang: Although the underground pedestrian system connects shopping malls in five directions and one metro station, it does not go further to form a big network;

b. Lujiazui: Although elevated walkways make up the interrupted walkway at the ground level, it is not big enough to cover a larger area. Pedestrians are still blocked by wide traffic roads after coming back down to the ground;

c. Xujiahui: The sky bridge only connects several buildings, which has not formed an elevated walking network;

d. Among the three areas, the role of buildings that working as nodes has not worked out completely.

(2) The integration degree between pedestrian space and buildings is low

a. Wujiaochang: all transition spaces are in buildings, the five important corridors remain the function of circulation only;

b. Lujiazui: the elevated pedestrian system does not integrate well with buildings;

c. Xujiahui: some underground walkways do not integrate well with buildings;

d. Among the three areas, most buildings are “introverted”, with mass wall facing walking space. What is more, there is not enough interaction space between building space and walking space.

(3) The functional support for pedestrian systems by buildings is not comprehensive

a. Wujiaochang: only Suning Appliance and Bailian building connect with metro stations;

b. Lujiazui: Multi-functions inside office buildings do not support walking behavior;

c. Xujiahui: the super long underground walkways are for circulation only, the

various functions inside buildings do not extend into walkways;

d. Among the three areas, most bus stops are distant from metro stations. Buildings contribute little to the pedestrian systems. In addition, most buildings do not offer multi-function support to pedestrian systems, such as retails, food shops.

(4) The comfort level and the sense of place are to be perfected

a. Wujiaochang: there are not enough accessibility facilities (such as elevators and ramps) between ground level and underground level pedestrian systems. Also, there are not enough accessibility facilities between underground walkways and buildings. The legibility of underground plaza is weak;

b. Lujiazui: inhuman scale and lack of infrastructure make it hard to establish a sense of place;

c. Xujiahui: lack of accessibility facilities; the quality of paving is poor;

d. Among the three areas, there are not enough shading devices and benches.

(5) The issues of sustainability need to be addressed

a. Wujiaochang: the underground pedestrian system is not big enough, while at the ground level, walkways are always interrupted by traffic roads. Therefore, an elevated connection system among buildings is needed, to fully take advantage of buildings. The way to integrate future elevated walkways into buildings is a tough question;

b. Lujiazui: the Pearl Ring, Century Bridge, Oriental Floating Court and Century Corridor are newly-built buildings, therefore there occurs some problems in terms of the integration of existing buildings with new-built walkways;

c. Xujiahui: The planning of Xujiahui shows an elevated connection among numerous buildings, while the connection between existing buildings and elevated walkways had not been considered about during the design phase of these buildings. Hence there would be the similar problems occurs in Lujiazui.

d. Among the three areas, the situations that utilize the space in reality differ from the designer’s consideration, to one degree or another. But a modification and improvement of these spaces has not taken place yet.

5.3 Design Concept and Design Strategy

Based on my analysis of Hong Kong, Bangkok and Boston, together with the three city centers in Shanghai, a design concept and the design strategy on the symbiotic relationship between pedestrian systems and buildings were developed.

The base idea of the symbiotic relationship between pedestrian systems and buildings is to clarify the role of buildings in pedestrian systems, make buildings

essential nodes, and to integrate the pedestrian systems. Especially in high-density cities, buildings can be utilized to connect the pedestrian systems on elevated, ground, and underground levels, contributing to safe, convenient and desirable walking environments.

Corresponding to the Five Assessment Methodology, I will summarize the following design strategies:

(1) Establish building and pedestrian systems that support the pedestrian environment and interconnect walkways on multiple levels, to establish a cohesive and supportive environment.

The continuity here does not represent underground and elevated walkways which only beyond or underneath the traffic roads (intersections). Thus passive measures force pedestrians to go upstairs or downstairs, without considering the convenience and efficiency of this walking behavior. Therefore, continuity in a symbiotic relationship based on the importance of buildings in pedestrian systems. Buildings should be essential transfer nodes in pedestrian systems, connecting each part of a walkway, in order to form a large walking network. Below are the detailed methods:

a. Buildings should connect underground, ground and elevated walkways. Also, buildings should work as transfer nodes in each horizontal level, to fully support the safety and continuity of walking, such as IFC in Hong Kong (figure 2.6), Copley Place in Boston (figure 2.70) and Oriental Floating Court in Lujiazui, Shanghai (figure 4.54).

b. The relationship between buildings and pedestrian systems could be series connections, parallel connections or the combination of series and parallel connections. And there needs to be at least two connection points between pedestrian systems and buildings. For example, in Bangkok, region two shows the series connection (figure 2.38), region one shows the parallel connection (figure 2.35), and region three shows the combination of series and parallel connection (figure 2.48).

c. Pedestrian systems and buildings should form a big network, such as the network in Hong Kong (figure 2.4), Skywalk in Bangkok (figure 2.23) and the advanced elevated walkway in Boston (figure 2.65).

(2) Ensure sufficient integration of building with pedestrian systems, to fuse the two spaces

The integration of pedestrian space with buildings is explored through the following relationships: whether two kinds of spaces overlap each other; whether there is transition space between two kinds of spaces; whether buildings open to pedestrian space. Detailed methods are listed below:

a. There are numerous ways buildings and pedestrian systems may integrate with

each other:

- Walkways pierce through the building (figure 2.6, figure 2.70);
- A short corridor connects building and walkway (figure 2.7);
- One branch of the walkway intersects the building (figure 2.8);
- Small shops interconnect building and walkway (figure 2.9);
- Open atriums / gardens connect building and walkway (figure 2.10);
- The ground floor is completely unenclosed (figure 2.13, 2.14);
- A portion of the ground floor which goes along the walkway is elevated (figure 2.15, 2.16);
- Building extends above the walkway (figure 2.17, 2.18);
- Skywalk connects with interior corridors (figure 2.32);
- Skywalk connects with interior open space (figure 2.33);
- Skywalk connects with interior platform (figure 2.34);
- Skywalk connects with interior aisle (figure 2.52);
- Building connects with sky bridge and exterior platform (figure 2.67)
- Sky bridge goes through the building and connects with ground level pedestrian system (figure 2.68)
- Building is part of the sky bridge (figure 2.69)
- Building sets back from walkways, leaving more space for the public (figure 2.71)
- Building connects one branch of the main walkway (figure 2.72)
- Walkway goes along the edge of the building, and connects with a roof garden (figure 2.73)
- Building sets back from the walkway, landscape inside the building enriches the view from walkway (figure 2.74)
- Walking space is enlarged in the portion of inside the building (figure 2.75)
- Pedestrian system connects with the atrium inside the building, and extends to the metro station which sits at the other side of the building (figure4.26);
- Pedestrian system connects with the commercial street as well as metro station inside the building (figure4.28).

b. Buildings should not be “introverted”. Instead, they should open to pedestrian spaces and reduce solid walls facing walking space, such as Wanda Plaza in Wujiaochang (figure 4.20). If the existing building is a large solid mass, the ground floor could be open and divided into several functional portions to reduce the scale.

(3) Ensure the multi-function support for pedestrian systems by buildings

The multi-function support for pedestrian systems by buildings could be explained by following items: whether buildings integrate with public transportation; whether there are multi-function shops along buildings. Detailed methods are listed below:

a. Buildings should closely connect with metro stations, bus stops and elevated rail system, such as the example in Hong Kong Central (figure 2.9, 3.11) , Bangkok (figure 2.21) and Boston (figure 2.64)

b. The functions along the edge of buildings should be various, and should be closely related to our daily life, such as World Wide House in Hong Kong (figure 2.9, 2.18), Central World in Bangkok (figure 2.53), Wanda Plaza in Wujiaochang (figure 4.20) and Oriental Floating Court in Lujiazui (figure 4.54).

(4) Improve the comfort level and legibility, to generate the sense of place as well as stimulate activities

a. Set up comfort elements in buildings as well as walking space

Numerous elements are included in comfort level:

Hardware facilities - accessibility facilities, shading devices, benches, traffic signs, telephone booths, restrooms, green space, landscape, sculptures;

Software facilities – detail design, background music, decoration, light, service;

If these elements are set up inside buildings (figure 2.27, 2.41, 2.85), the ability to walk by buildings would be fully expressed; if these elements are set up at the connection area between buildings and walking space (figure 2.39, 4.40), the boundary of buildings will be weakened. Especially at underground level, the comfort level is highly important, which would directly affect walking experience.

b. Enhance the legibility of spaces, in order to stimulate activities. And the time when people could use public space should be ensured, to create the sense of place, such as Wanda Plaza in Wujiaochang (figure 4.20).

(5) Maintain the sustainable development of the dynamic system formed by buildings and pedestrian systems.

a. The integration of buildings with pedestrian systems cannot be achieved without the support of the government. Numerous policies are adopted by Hong Kong and Bangkok governments to encourage the connection between buildings and walkways.

b. Set aside connection area with walkways in buildings is essential to meet the future needs and development. Especially in high density centers, the future population growth should be taken into consideration when designing buildings. Therefore at the underground or elevated level of buildings, some additional connection area is needed.

c. By doing research on building environments after buildings are put into use, finding out difference between utilized condition and design intent, the improper part could be modified or redeveloped.

Chapter 6 Design for Wujiaochang

6.1 Introduction

Based on the 5 design strategies I proposed in Chapter Five, my design for Wujiaochang not only fully implemented the 5 design strategies, but also carefully considered how to define spaces, how people would use the spaces, and what kind of activities could happen in each specific space.

6.2 Design Concept and Specific Solutions

The current pedestrian system in Wujiaochang is incomplete and pedestrian movement is interrupted by vehicles at the ground level (figure 4.12). As I mentioned in the previous chapter, buildings do not act as nodes to support pedestrian behavior. Overall, there are not enough transitory spaces between buildings and pedestrian systems, which cause the isolation of buildings with their surroundings.

Luckily, there is one site within Wujiaochang still under construction, this provides an opportunity for improving the whole area by taking advantage of the site (figure 6.1, 6.2, showed in red). Therefore, I implemented the 5 design strategies into the building/site design. At the same time, the pedestrian system at different levels in the entire area was addressed. The goal of the design is to create buildings the act as essential nodes, in order to connect the pedestrian systems, contributing to a safe, convenient, efficient and desirable walking environment.

Figure 6.1

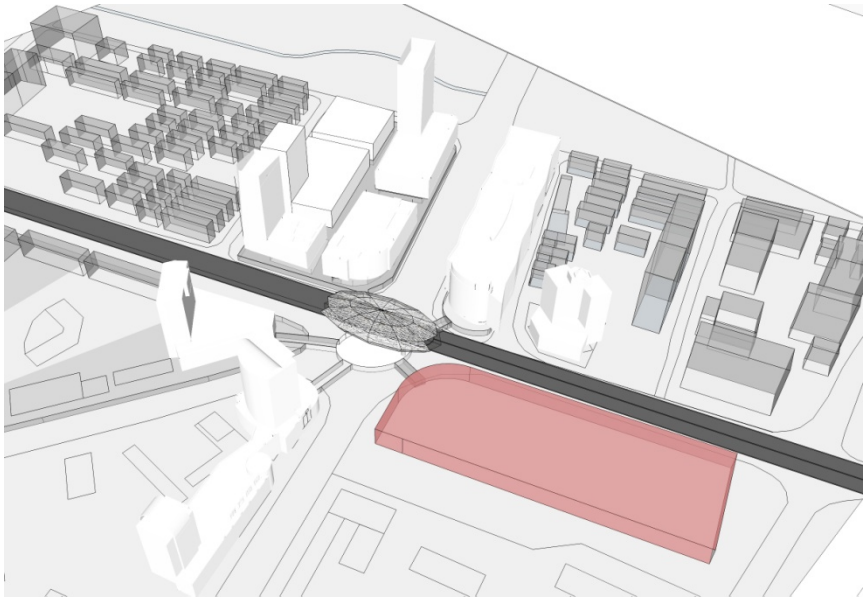


Figure 6.2

(1) Establish building and pedestrian systems that support the pedestrian environment and interconnect walkways on multiple levels, to establish a cohesive and supportive environment (figure 6.3).

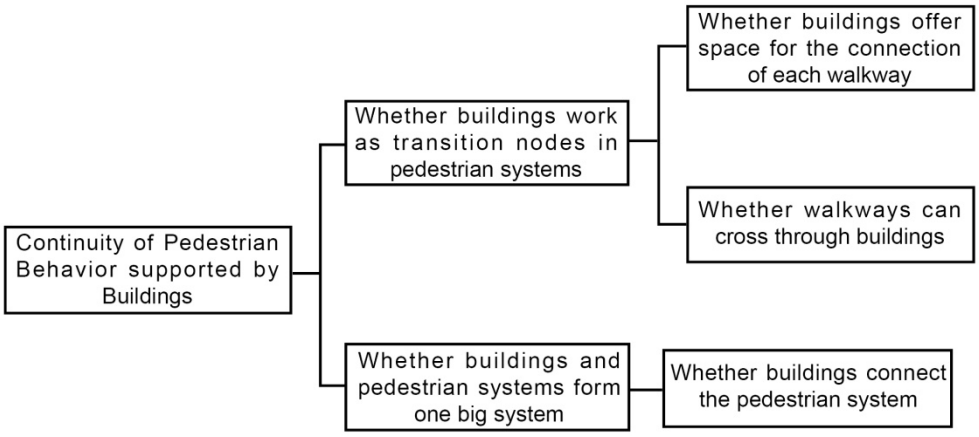


Figure 6.3

Starting with the entire area of Wujiaochang, I focused on creating a cohesive pedestrian experience. From current situation (figure 6.4), there are at least 6 points (shown in dash bubbles) where walking is interrupted by traffic flow at ground level. Therefore, an elevated pedestrian system is proposed (figure 6.5), in order to connect all broken points, and simultaneously, connect bus stops and metro stations through the elevated walkway. Thus, the elevated pedestrian system would significantly contribute to the continuity of the pedestrian experience.

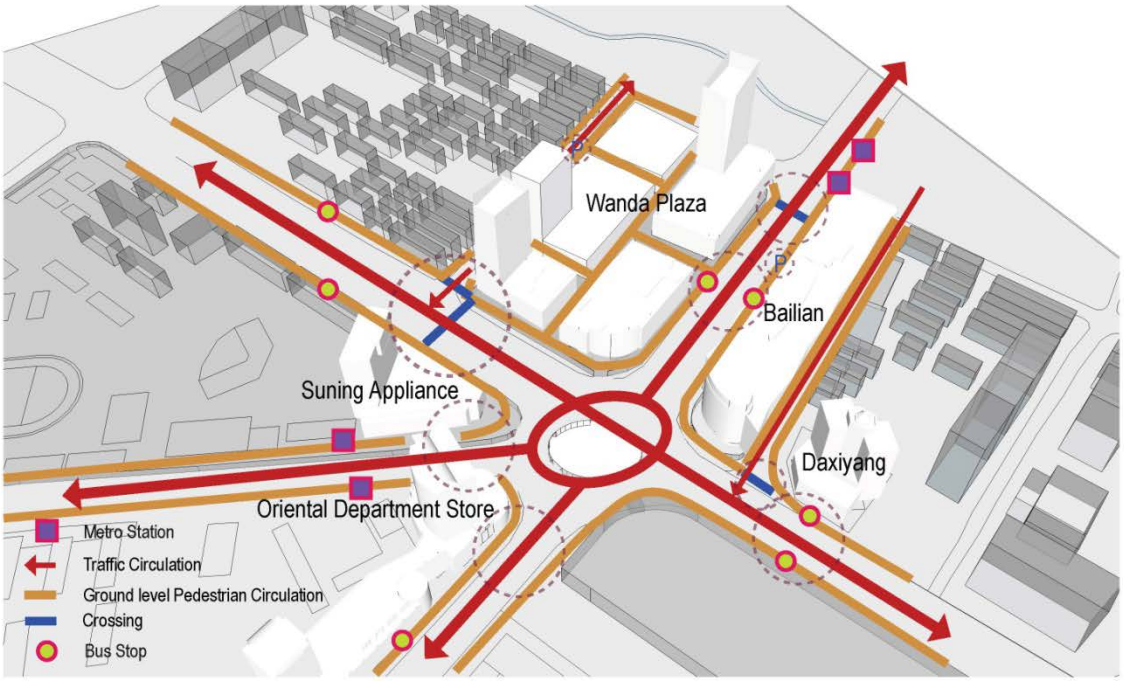


Figure 6.4

Figure 6.5

At the underground level, although the pedestrian flow it is much better than ground level, the efficiency is good only in the center area (figure 6.6). Therefore, I extended the underground pedestrian system by creating more connections. Also, I created three accesses into my site. Among them, one connects with the center circle, and the other two connect with metro stations (figure 6.7), in order to provide a more efficient walking environment.

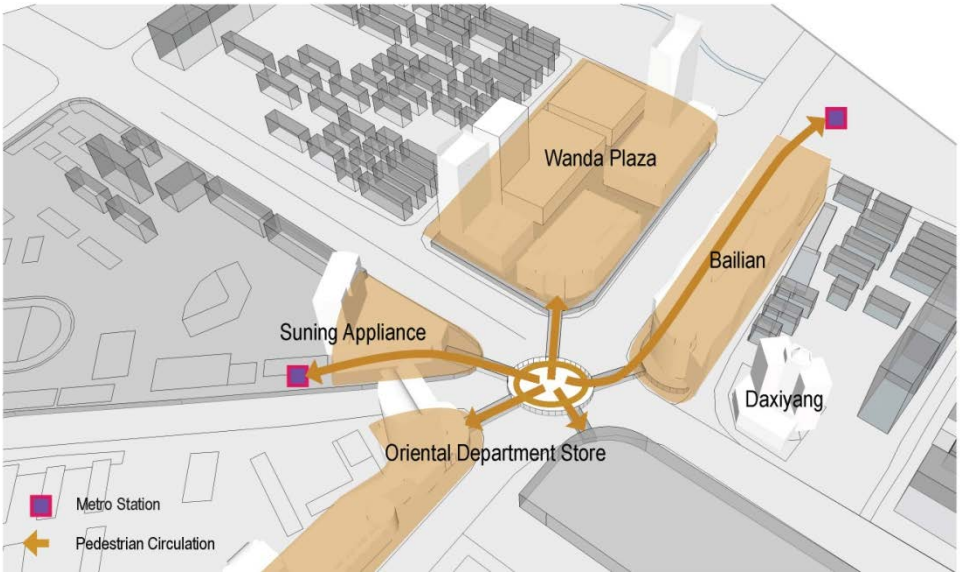


Figure 6.6

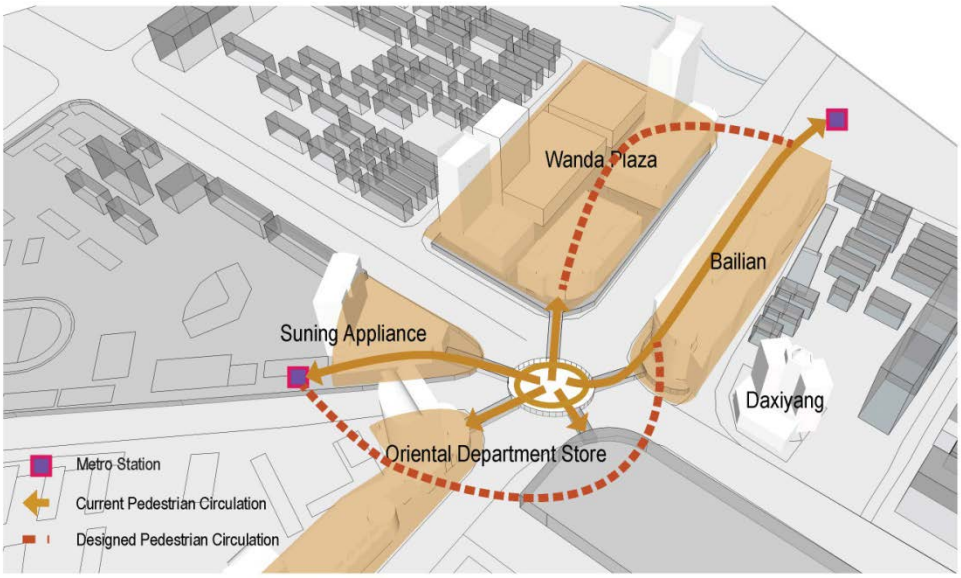


Figure 6.7

Early in my study, I divided the site into several smaller parts (figure 6.8), to create a more pedestrian-friendly and more easily stimulate street life. The best example would be Wanda Plaza in Wujiaochang, which, as I mentioned before, is the most dynamic place of the entire area. After analyzing possible entrances and their visual impact, I formed several large public spaces connected by well proportioned streets (figure 6.9).

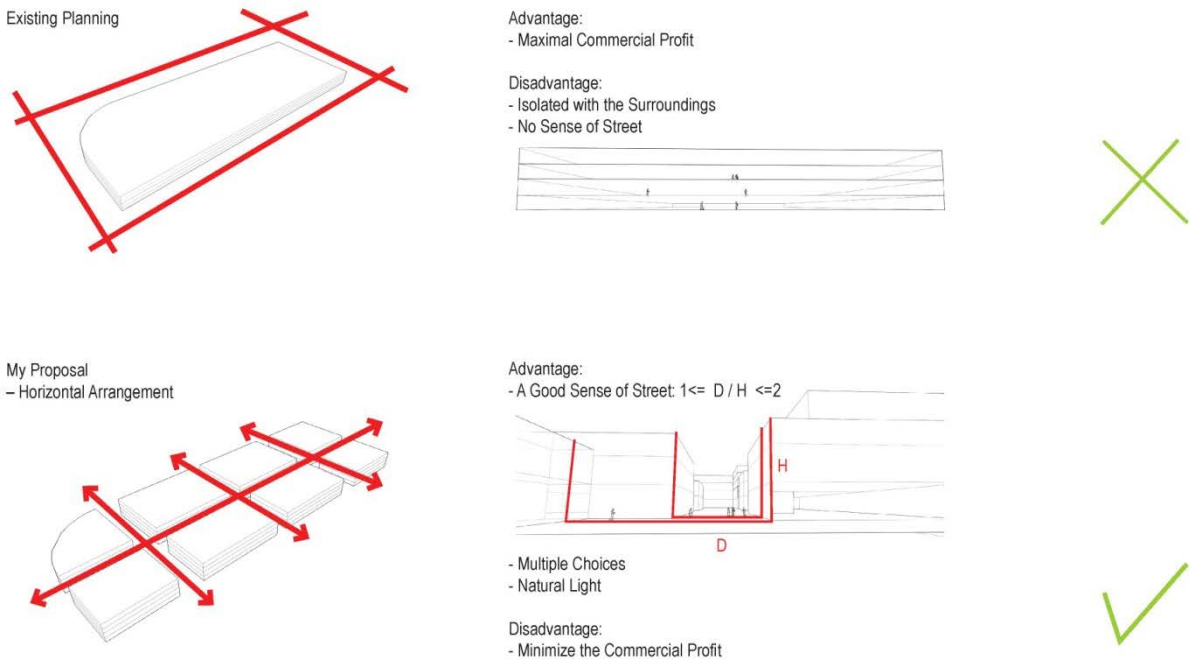


Figure 6.8

Figure 6.9

We can see from the model that pedestrian systems and buildings are fused into one big system (figure 6.10), the goal is to make it hard to tell which part belongs to pedestrian system and which part belongs to buildings, a fusing of both into something new. In my design, buildings are essentially transfer nodes along the walkway, they not only connect underground, ground and elevated walkways, but also work as transfer nodes in each horizontal level, to fully support the safety and continuity of walking. (Figure 6.11, 6.12 6.13, 6.14, 6.15)

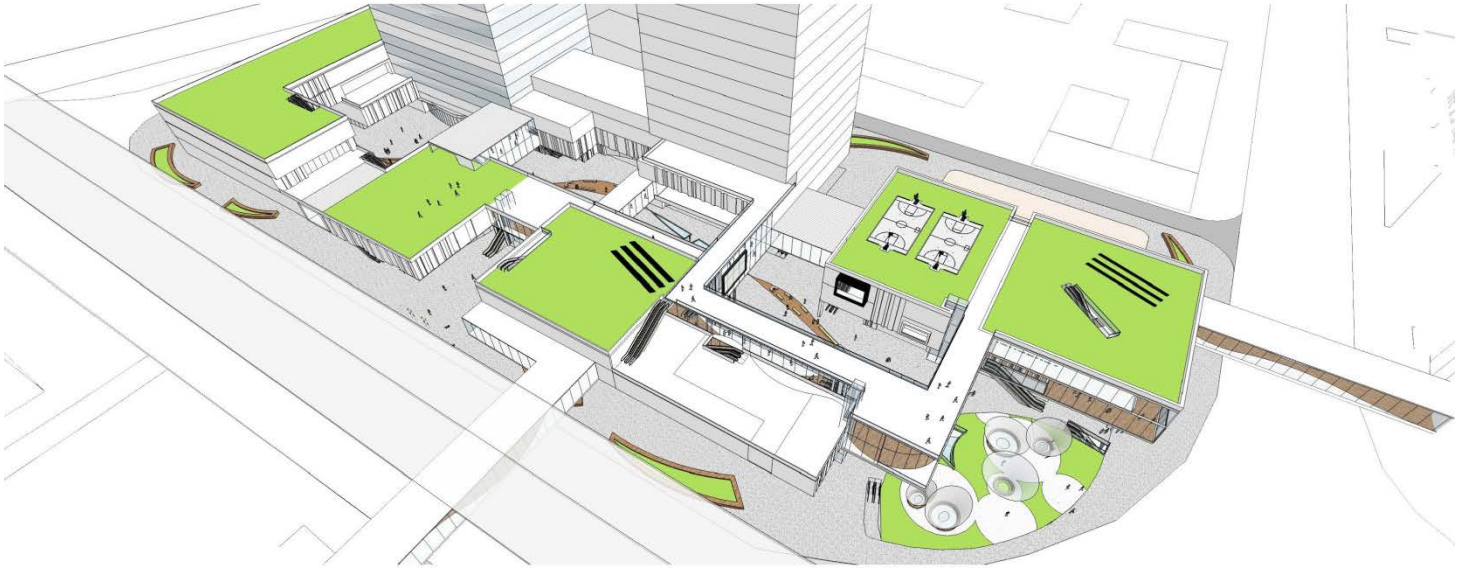


Figure 6.10

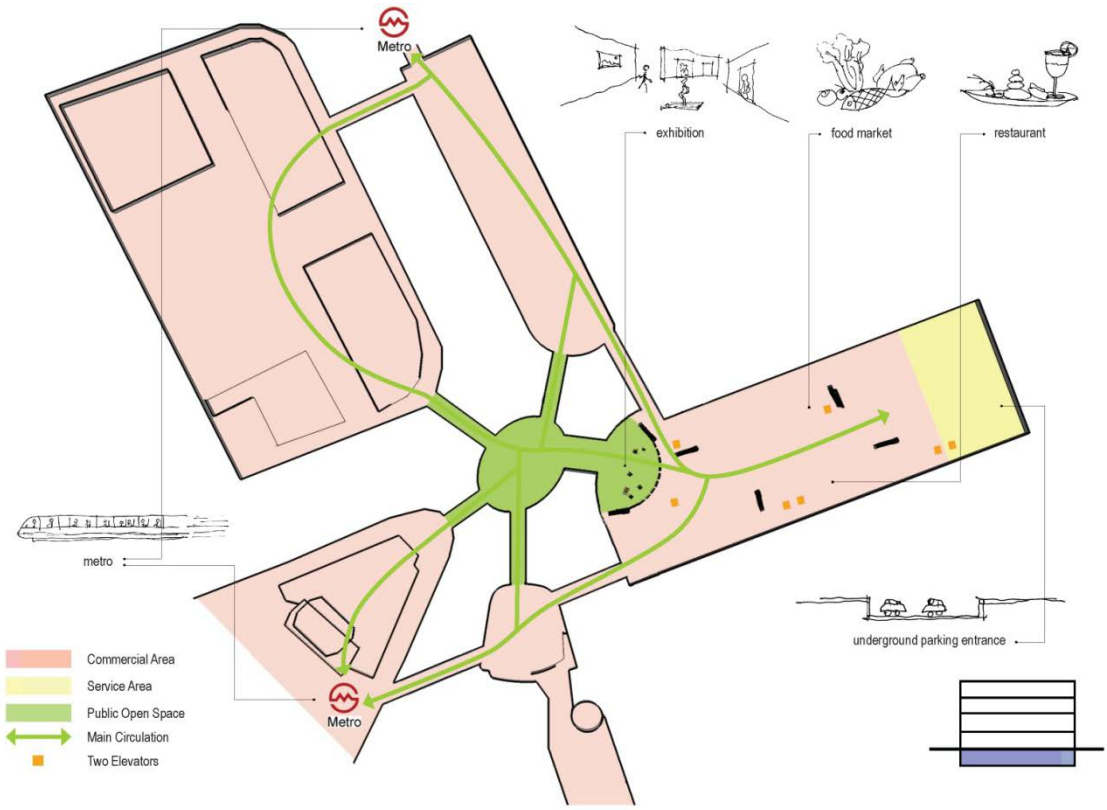


Figure 6.11

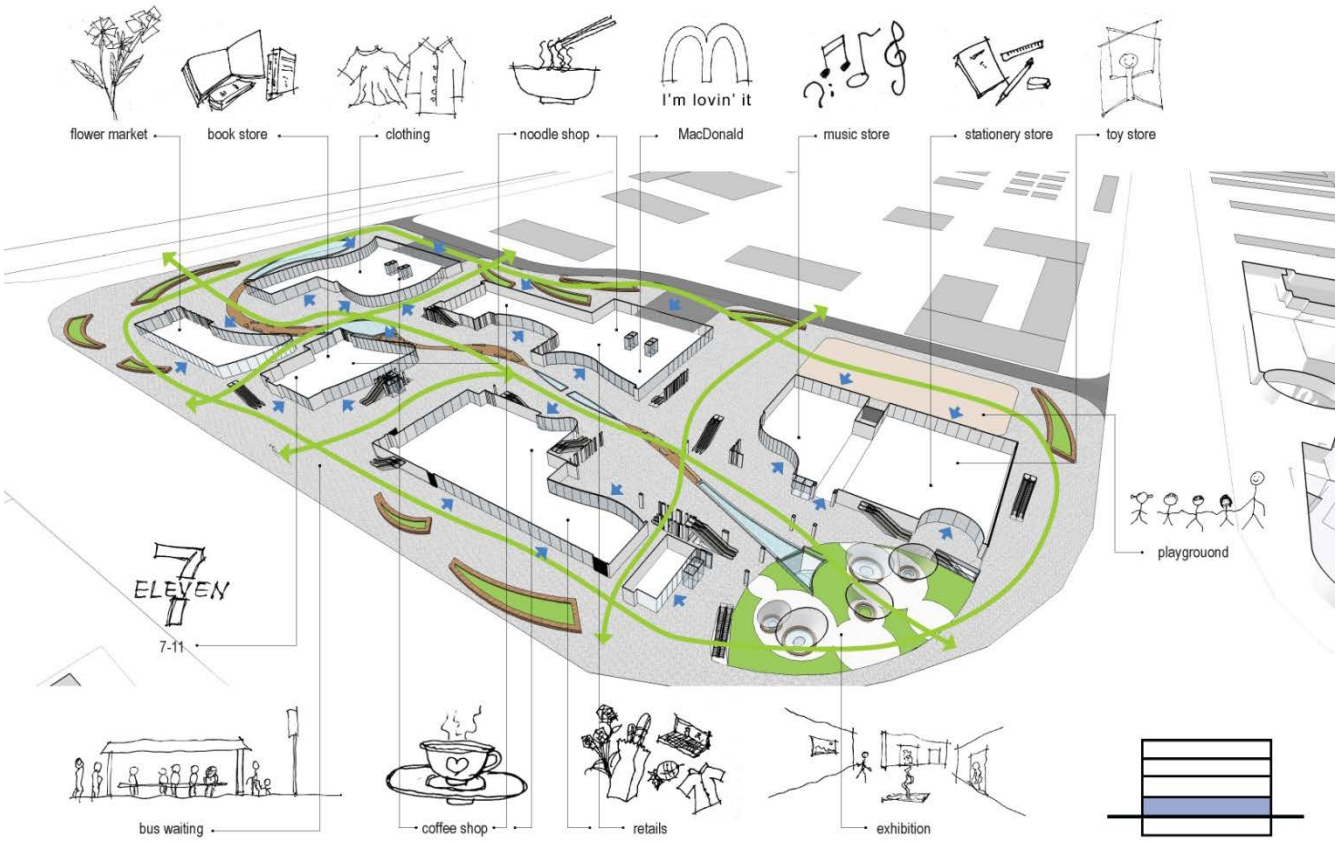


Figure 6.12

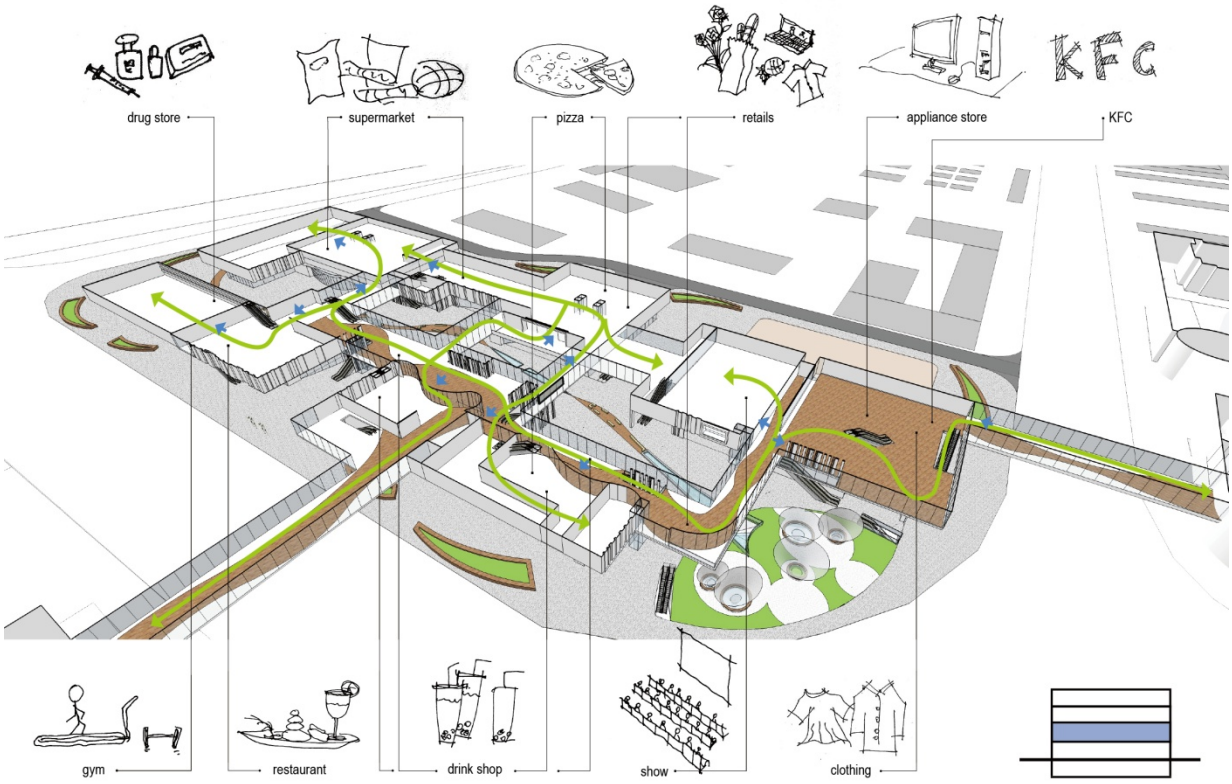


Figure 6.13

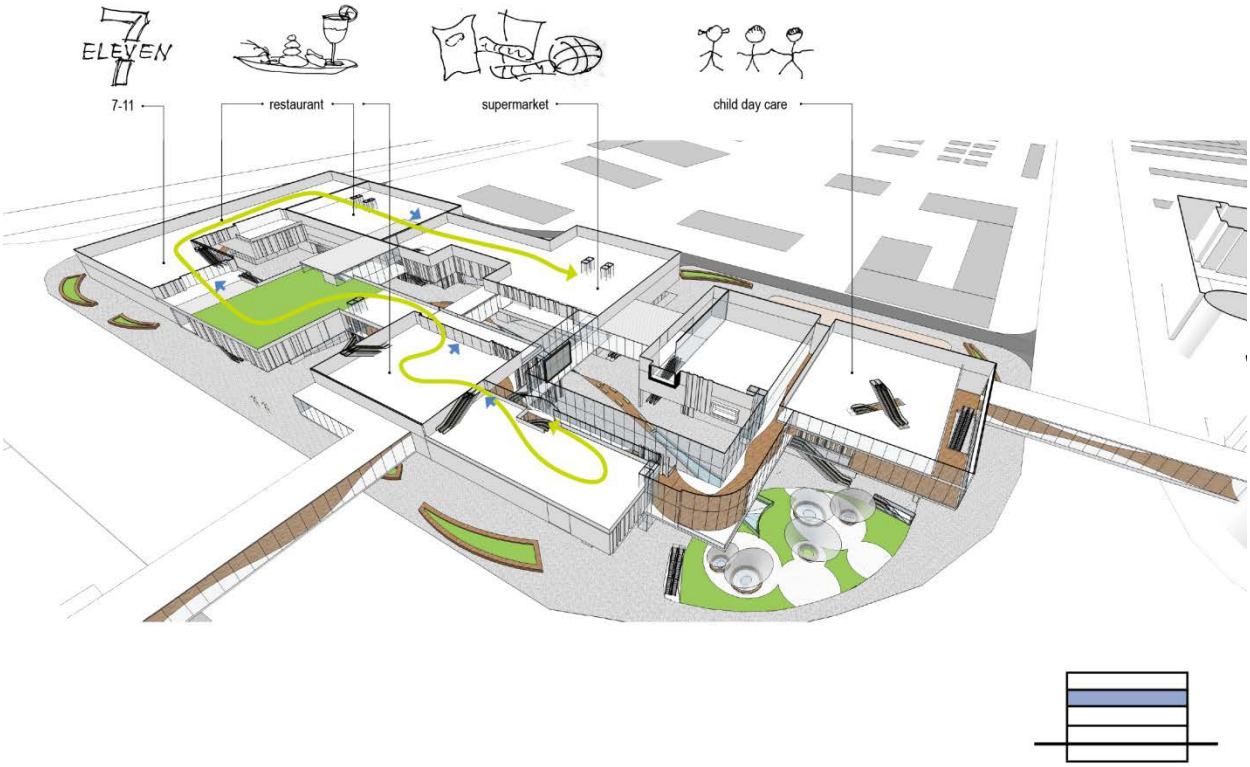


Figure 6.14

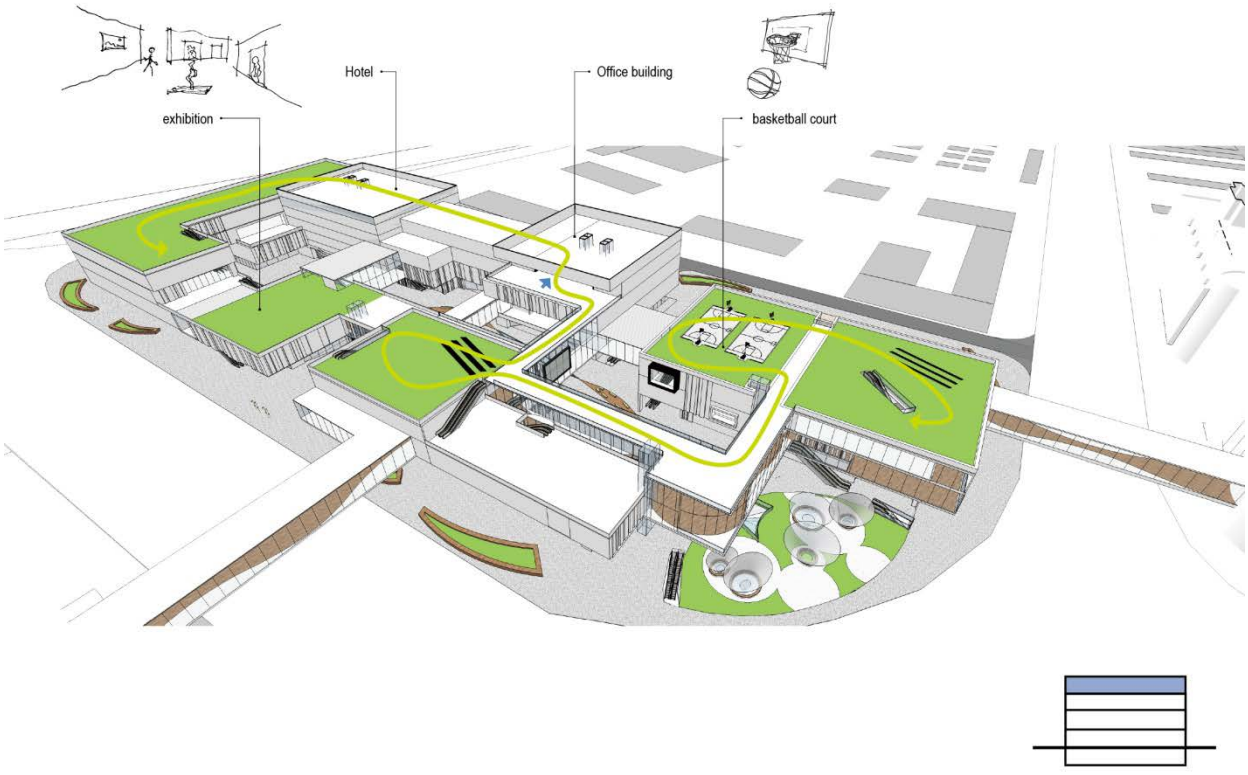


Figure 6.15

(2) Ensure sufficient integration of building with pedestrian systems, to fuse the two spaces (figure 6.16)

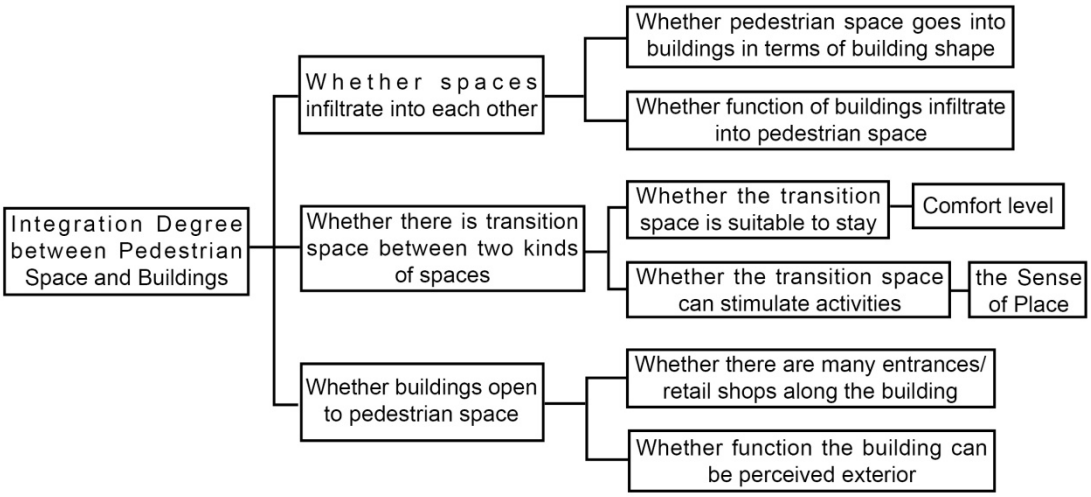


Figure 6.16

As I summarized in the previous chapters, there are a variety of ways that buildings and pedestrian systems integrate with each other, such as walkways pierce through the building (figure 2.6), a short corridor connects building and walkway (figure 2.7), and so on. Therefore, I integrated healthy modes and transferred them into my design.

a. Walkways pierce through the building (figure 6.17)

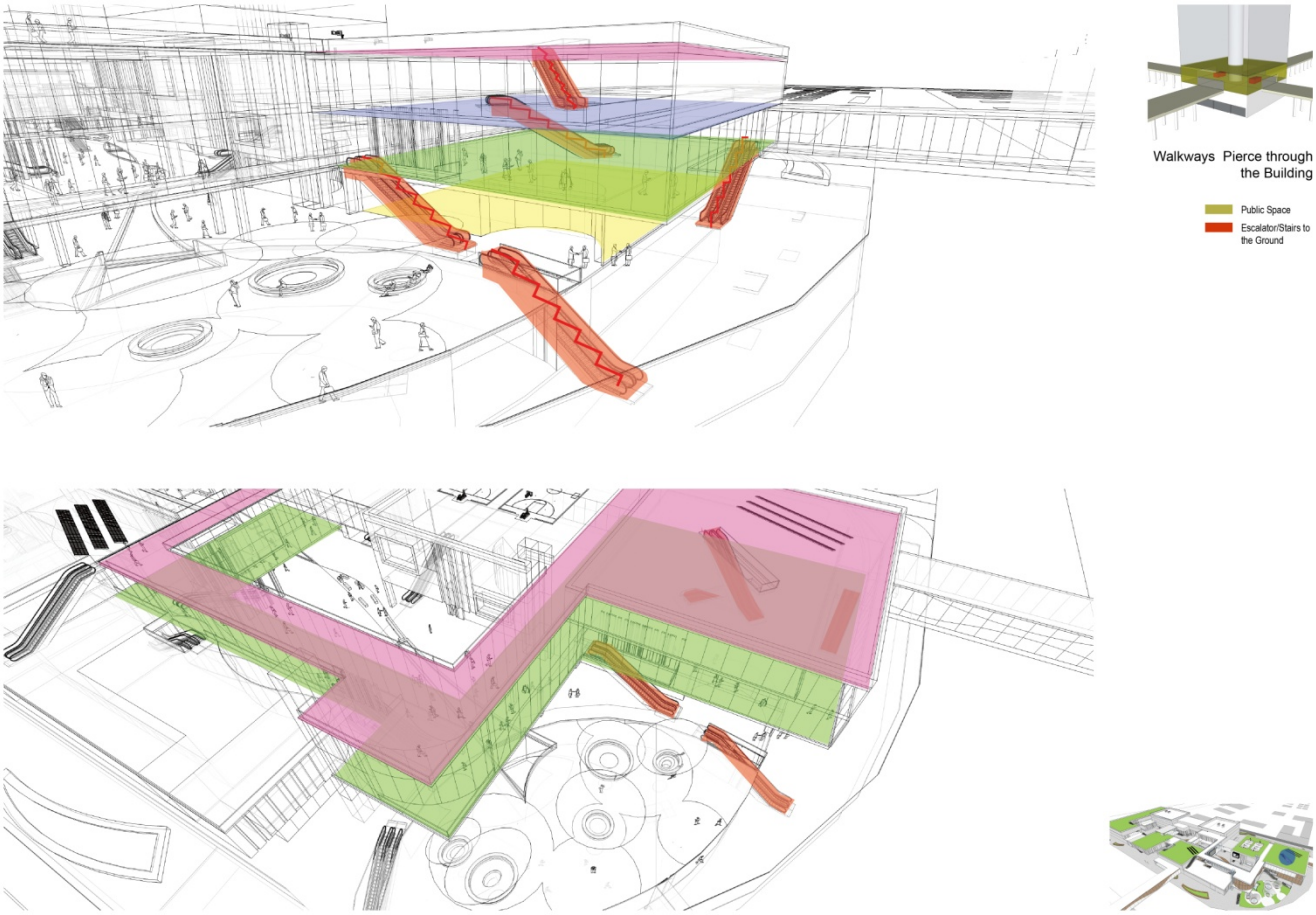


Figure 6.17

The building itself is part of the pedestrian system. By that I mean, the building can be regarded as an enlarged walkway. The building connects pedestrian systems at three levels, as well as supports the continuity of ground and elevated pedestrian systems.

b. One branch of the walkway intersects the building (figure 6.18)

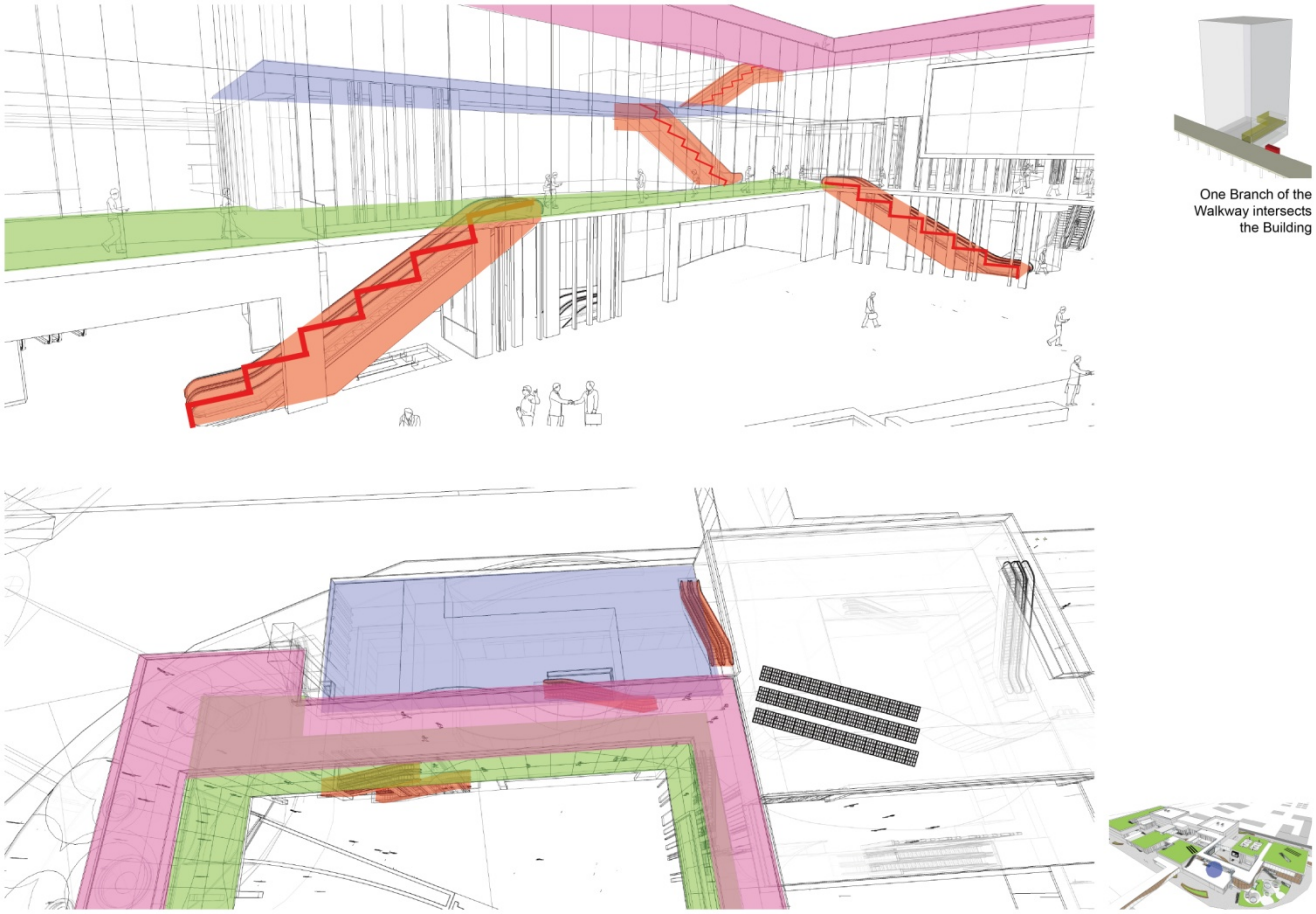


Figure 6.18

The escalators lead people to the elevated pedestrian system, where one branch of the walkway process through the building, to lead people to the public roof garden. The building and walkways are fully integrated with each other.

c. Elevated plaza connects buildings and walkway (figure 6.19)

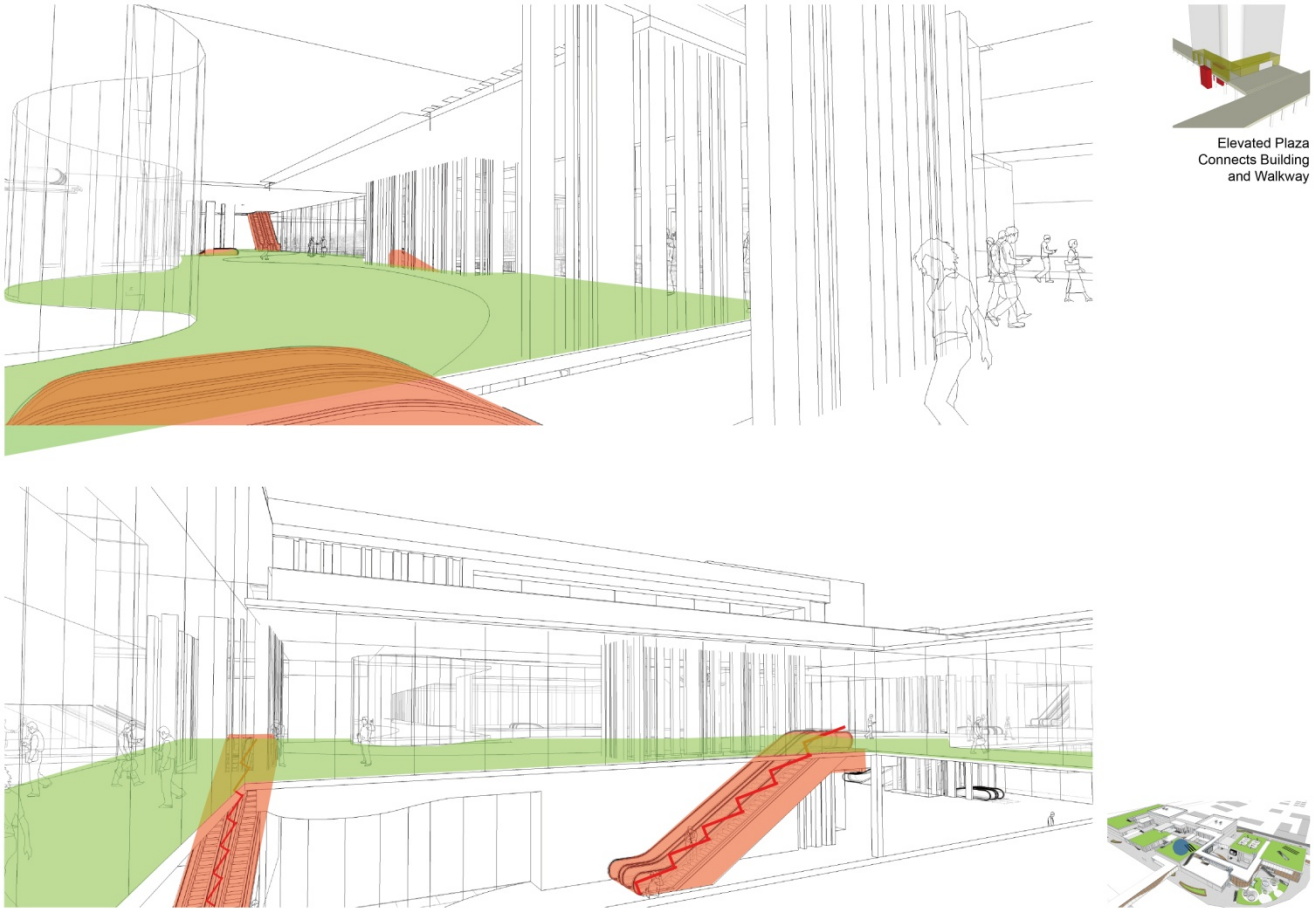


Figure 6.19

The enclosed elevated plaza is part of the walkway, and it should be regarded as part of the building as well. The boundary of the building is reduced, enabling the building to serve the pedestrian systems. It is an important transition space, where diverse activities would take place.

d. Small shops interconnect buildings and walkway (figure 6.20)

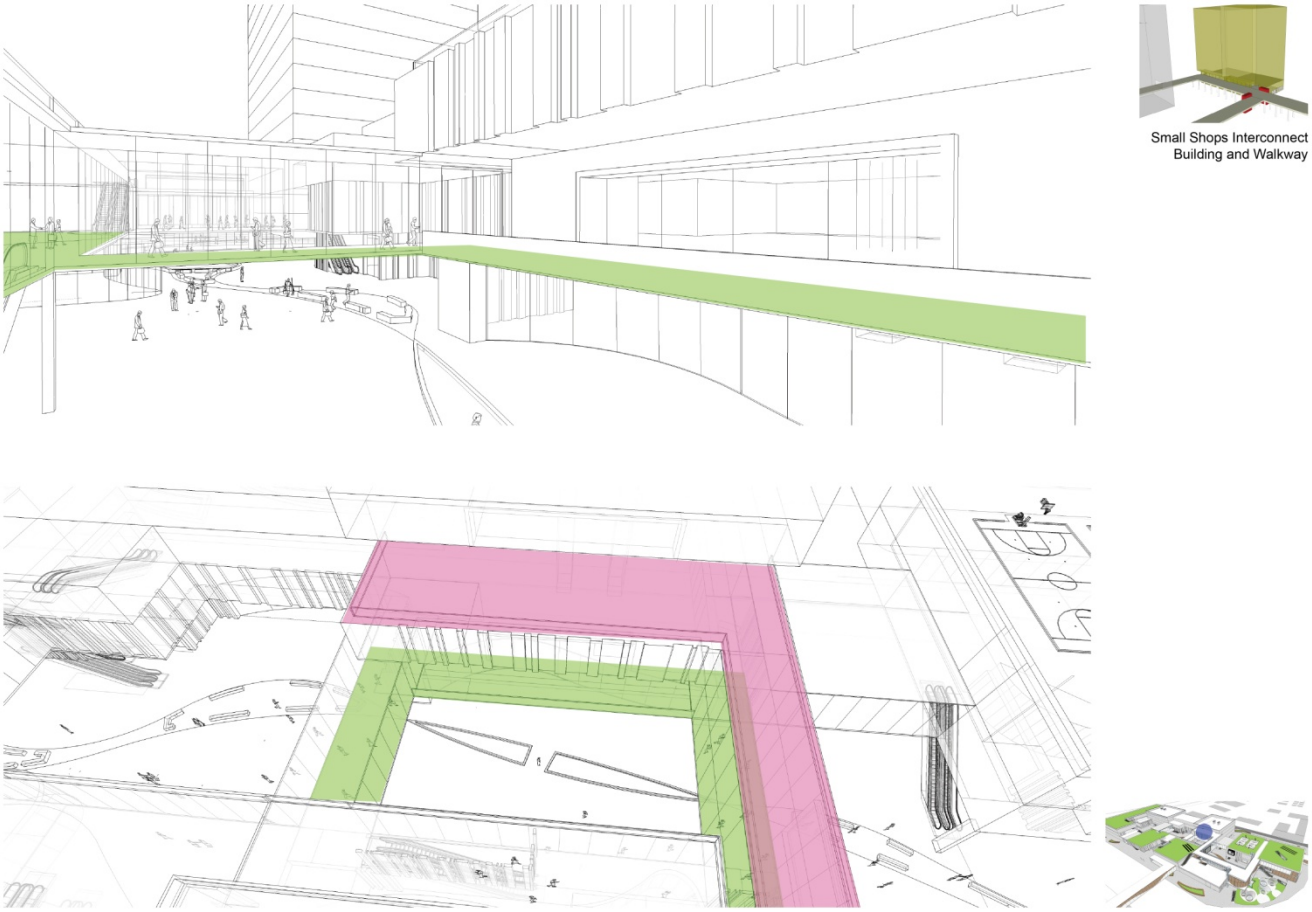


Figure 6.20

The edges of the building are filled with various shops, such as noodle shops, cafés, bookstores, or retail, which allows for a more porous building. The building provides functional support for the walkway, which makes the walkway not only for circulation, but also for entertainment, dining and socializing.

e. A short corridor connects building and walkway (figure 6.21)

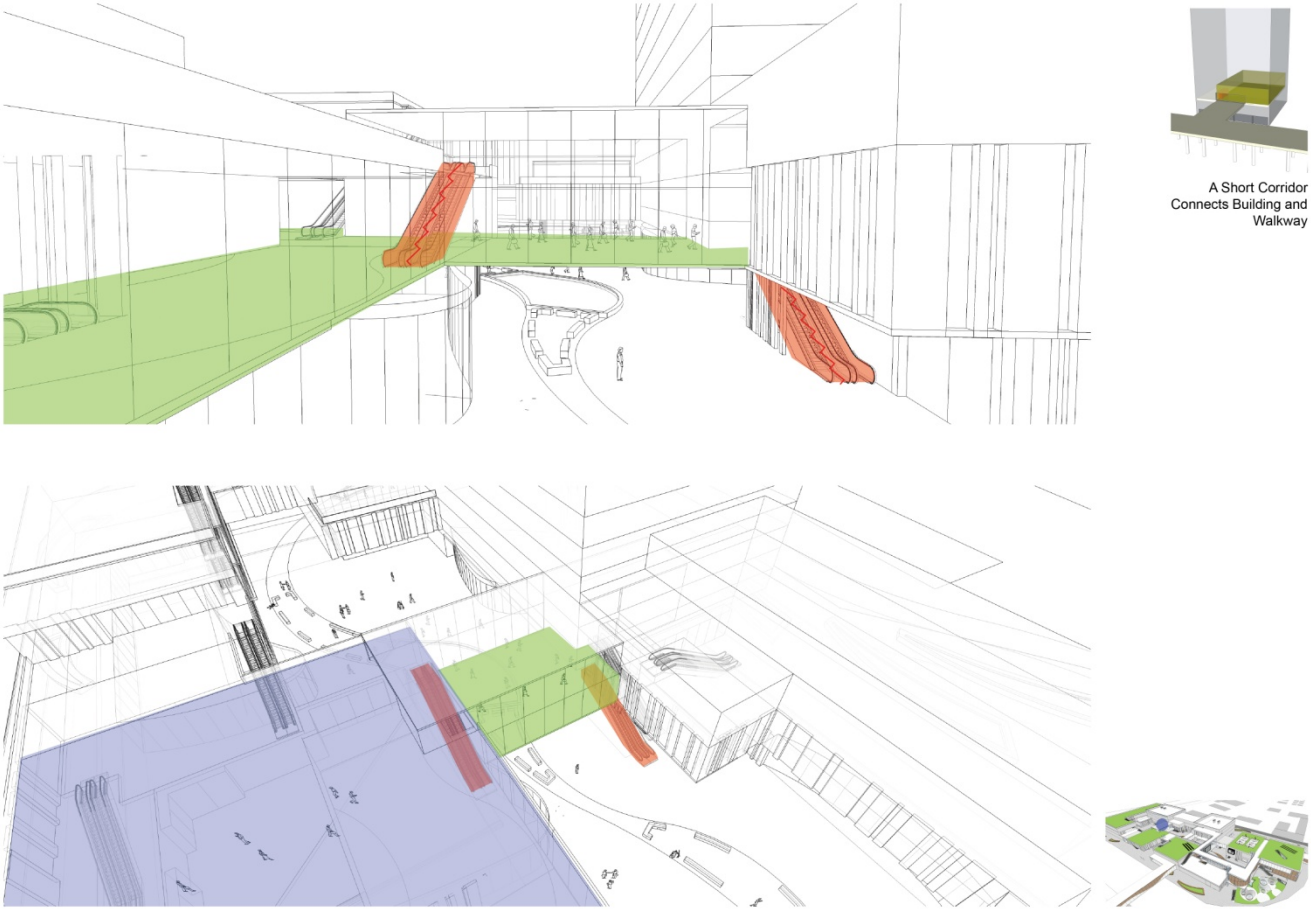


Figure 6.21

In the mode of Hong Kong, the corridor is only for circulation. But I gave it more functions in my design. The corridor is wide enough to put in tables and chairs, and also accommodates some vending machines inside the corridor (figure 6.34).

f. Walkway connects with exterior platform (figure 6.22)

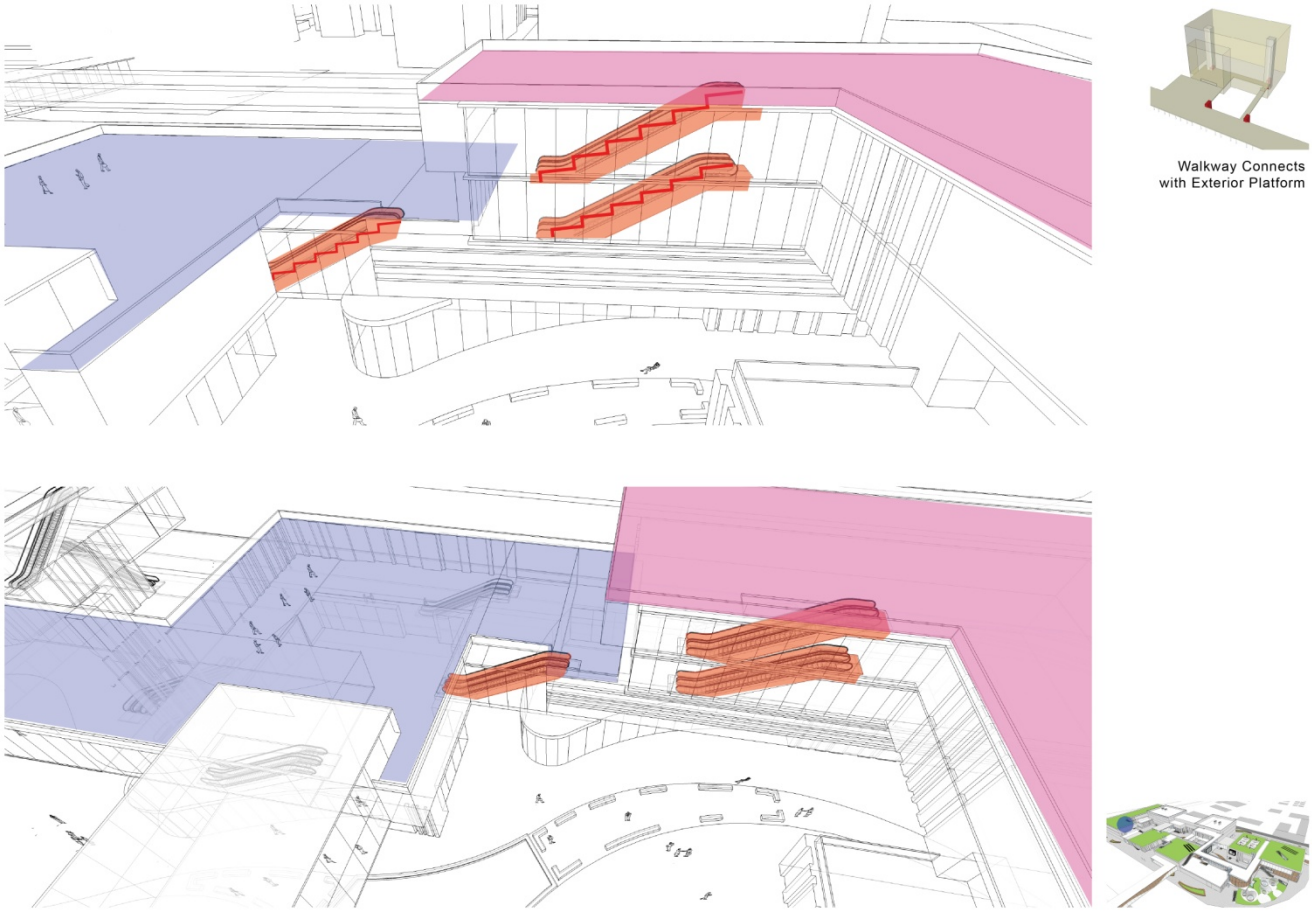


Figure 6.22

Taking escalators to the third floor, you will pass by an exterior plaza before entering the building. The enlarged plaza is another kind of transit space, which provides a place for socializing and various activities.

g. Walkways connects with interior aisle (figure 6.23)

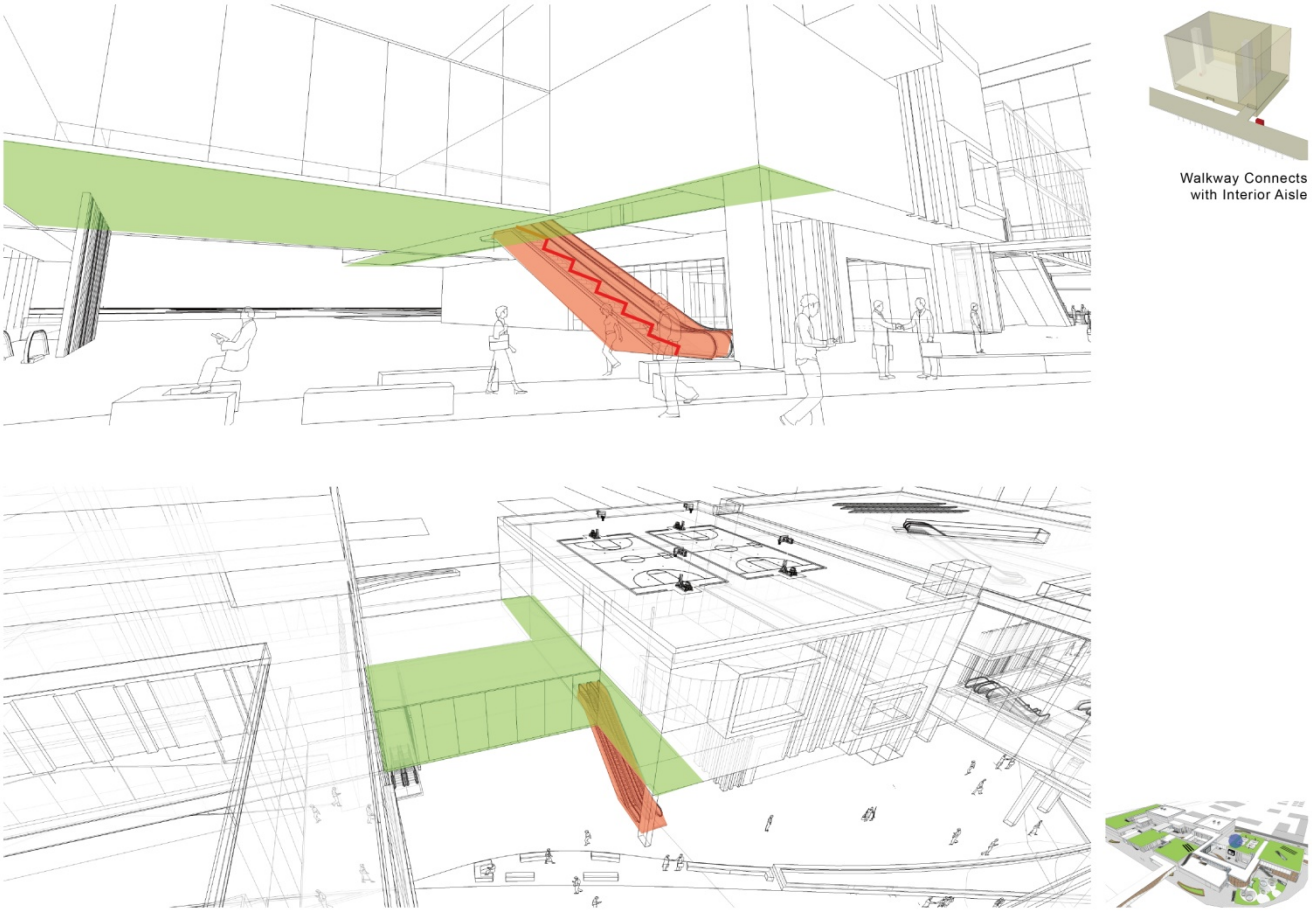


Figure 6.23

Just like the example of Bangkok (figure 2.52), the interior aisle is part of the building, and it is also part of the elevated pedestrian system. And functions along the aisle serve not only for the building but also for pedestrians passing by.

h. Series connection (figure 6.24)

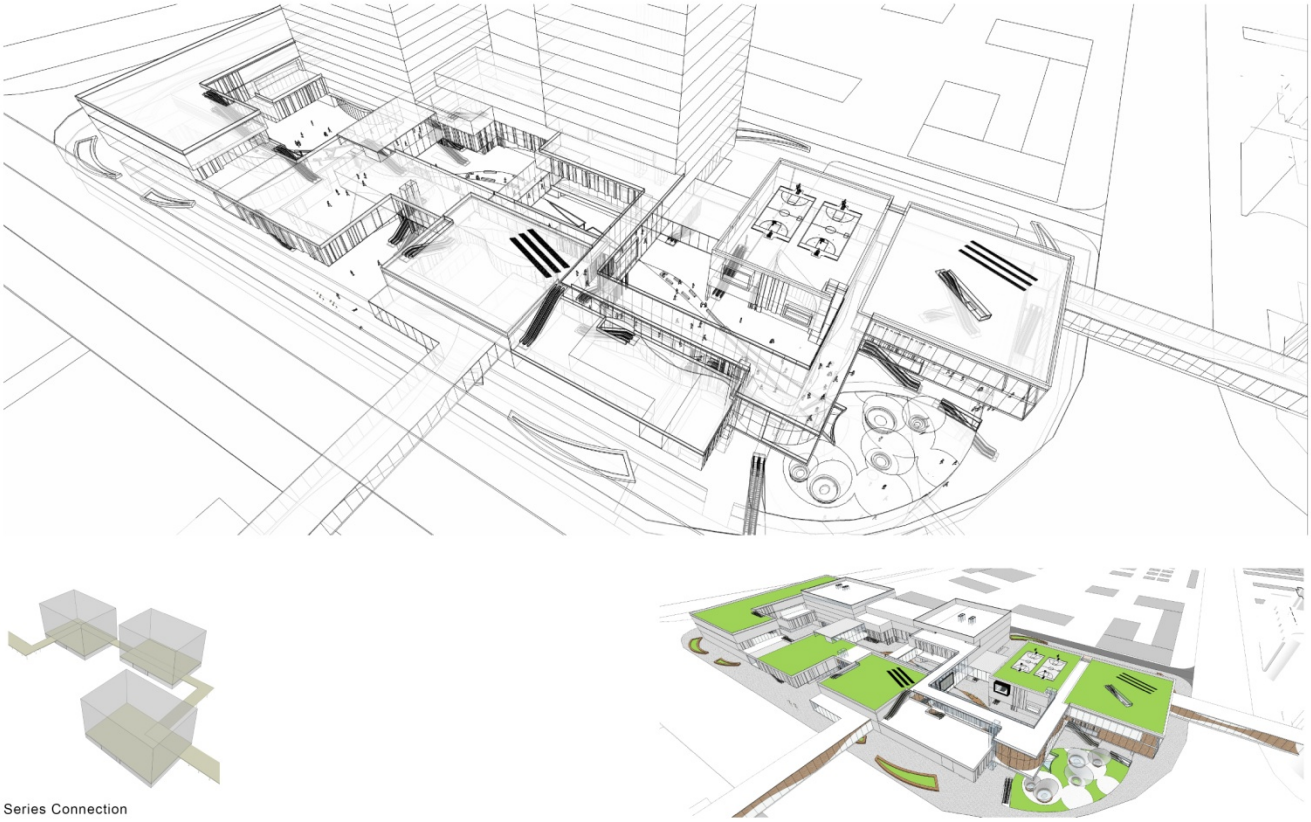


Figure 6.24

Buildings in the site are fully connected by pedestrian systems at multiple levels (in other words, each portion of the walkways are connected by buildings), which, is the best way to integrate buildings and pedestrian systems based on my previous numerous analysis. The buildings work as nodes to support the continuity of walking and provide functional support, as well as to reduce the competition between vehicles and pedestrians. Therefore, the walking space would be greatly improved.

At ground level, shops all open to the public, which reduce a sense of solid boundary of the building, enhancing the integration of building space with walking space. It is easy to feel the interior space from outside. Also, some parts of the buildings are unenclosed. (Figure 6.29-6.32)

i. A portion of the ground floor which goes along the walkway is elevated (figure 6.25)

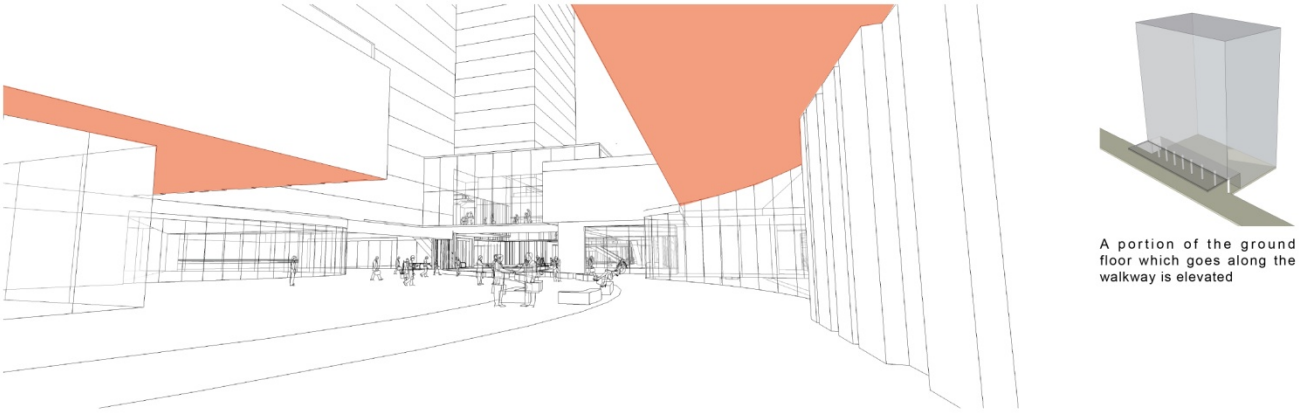


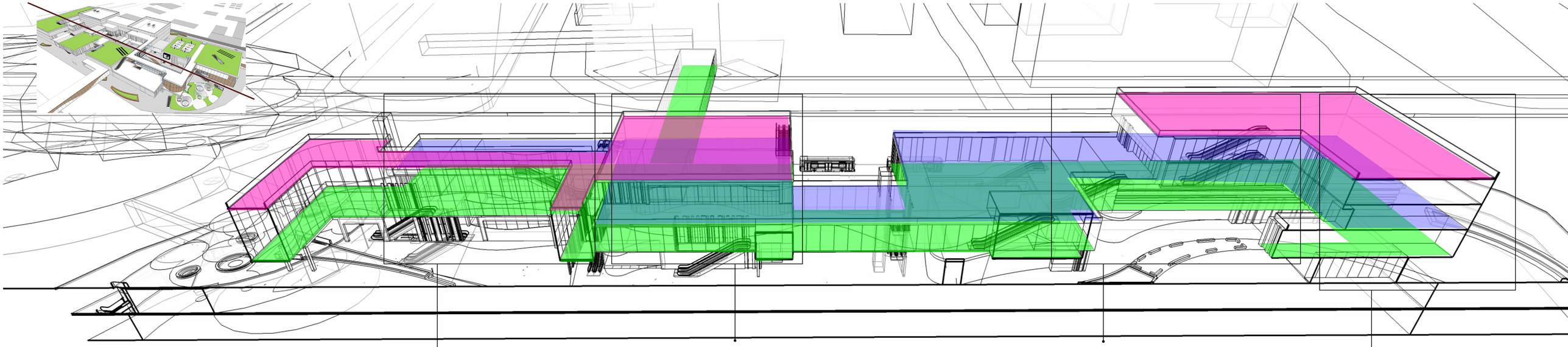
Figure 6.25

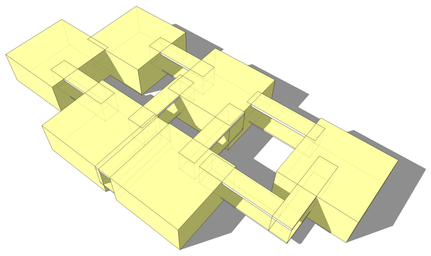
An intermediate space between exterior and interior is formed, enable people to stop and socializing. To a certain extent, more business opportunities are raised by this kind of space.

j. Building extends above the walkway (figure 6.26)

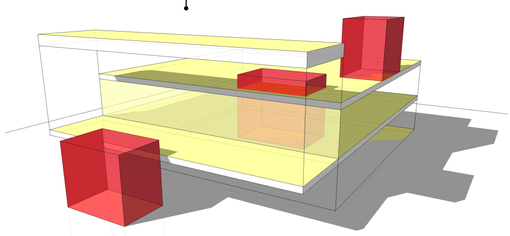
Figure 6.26

The space above the sidewalk belongs to the pedestrian system as well as the building, which reduces the boundary of the building, fusing building space and walking space.

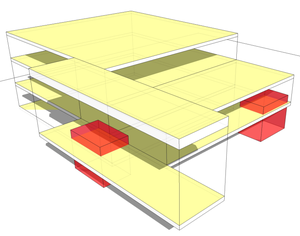




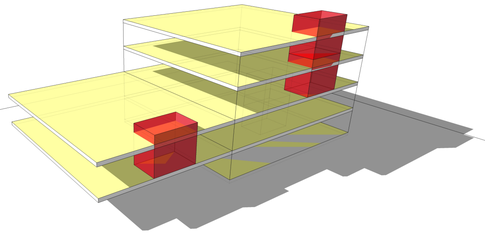
Series connection



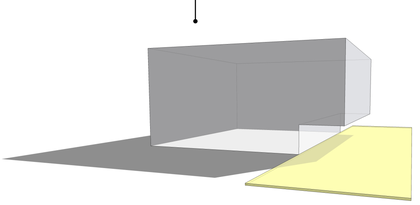
One branch of the walkway intersects into the building



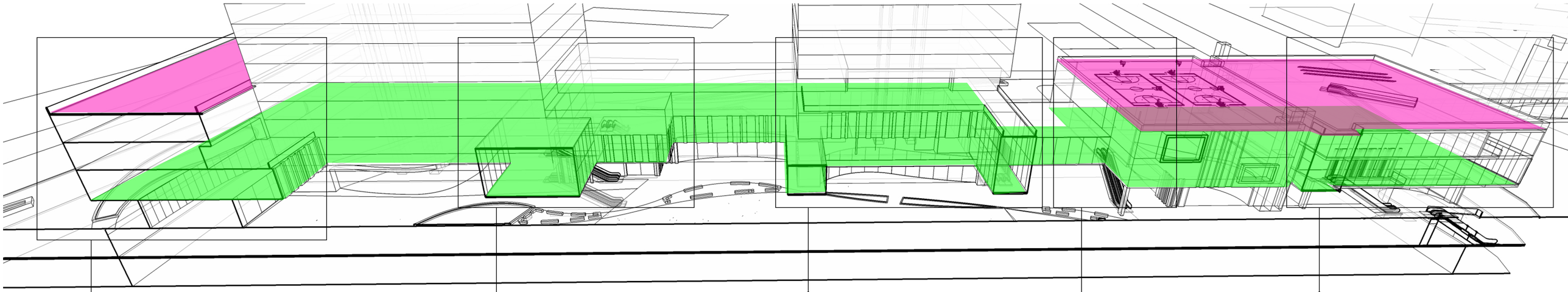
Elevated plaza connects buildings and walkway

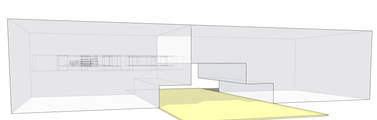


Walkway connects with exterior platform

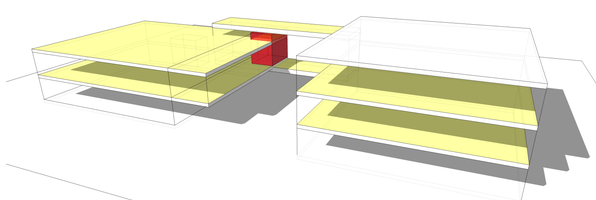


A portion of the ground floor which goes along the walkway is elevated

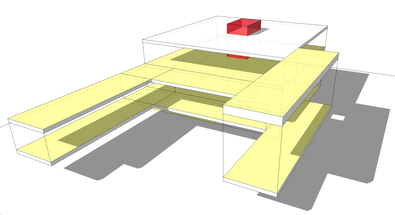




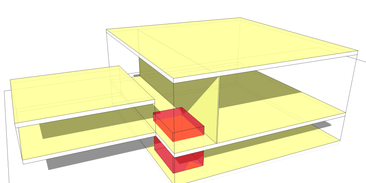
Building extends above the walkway



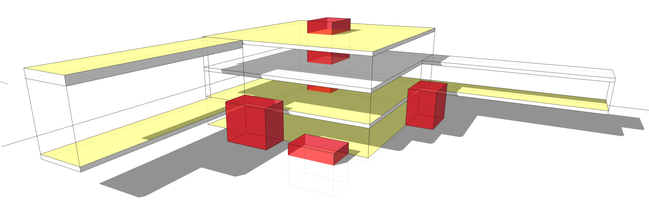
A short corridor connects building and walkway



Small shops Interconnect buildings and walkway



Walkways connects with interior aisle



Walkways pierce through the building

Appendix A　Connection Methods between Buildings and Pedestrian Systems

(3) Ensure the multi-function support for pedestrian systems by buildings (figure 6.27)

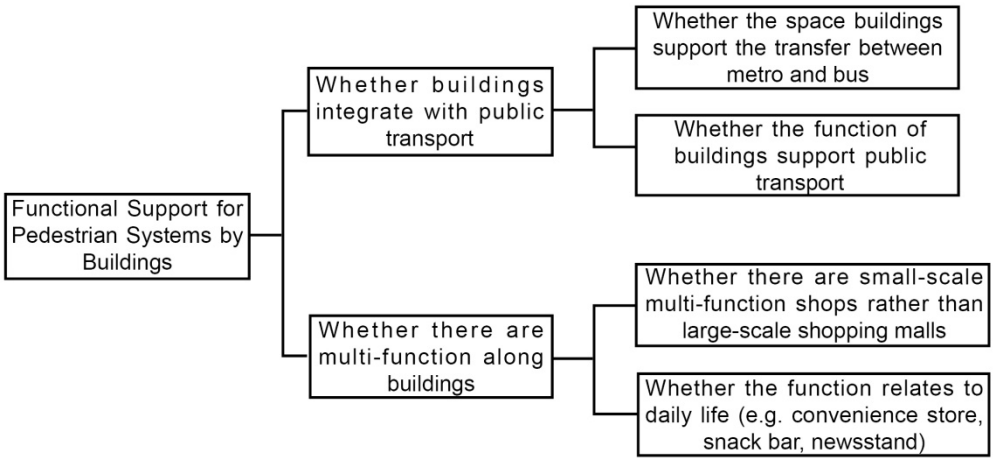


Figure 6.27

a. At the underground level, because the existing metro station is removed from the site, I shortened the distance by adding direct or indirect connections (figure 6.11). At ground level, a large public plaza was designed near the bus stop which provides additional space for the waiting passengers. Escalators connecting the elevated and underground levels all lead to the bus stop, which enhances the connection between buildings and the bus stop. Thus, the pedestrian behavior becomes more efficient and spatially rewarding (figure 6.28).

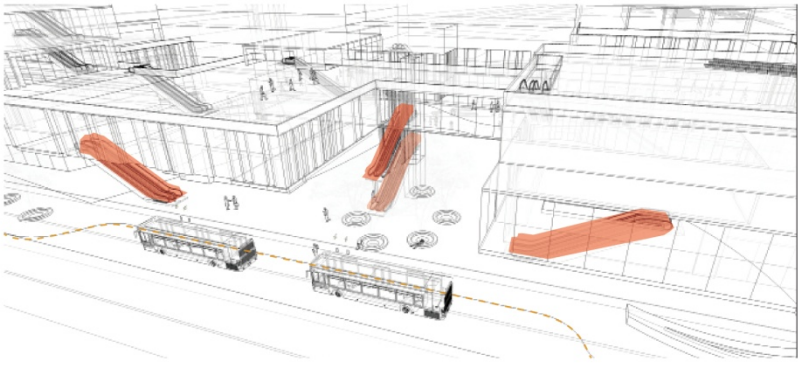


Figure 6.28

The elevated walkway is directly above most of the bus stops and all of the metro stations in the project area. Therefore, accessibility to the transit system is easily facilitated to and from the elevated pedestrian system (figure 6.5, figure 6.13).

b. There are a variety of functions which unify buildings and walkways, which greatly reduce the hard edges of the buildings, and increase the pedestrian activities on the walkways. The functions are closely related to daily life, examples include noodle shops, food markets, retail, convenience stores, book stores, fast food, and etcetera. (Figure 6.11-6.15, 6.29-6.32)

The function inside the building (music store) infiltrates into outside (walkway), which enriches the pedestrian system. Performance acts as the connector between interior and exterior, making the space much dynamic. Pedestrians are attracted by the music, and the wide street enables them to stop or sit, to fully enjoy the entertainment and urban life.

Figure 6.29 Music Plaza

Tables and chairs allow the boundary of the building to be more porous, which combines both the interior and exterior spaces. People can easily recognize the functions from outside, even from 10 meters away. These tables and chairs create a desirable relaxing and socializing space.

Figure 6.30 Dining Plaza

Fast food and retail shops are popular. They serve a large percentage of the population. Doors are often the greatest obstacle between interior and exterior spaces. In order to fully connect the interior and exterior, doors are replaced by framed openings. The frames define the space while the roller shutter door behind the frame will protect the safety of the store during night. The space becomes more flexible and interesting because of the transitional space, and the shape of the “doors” is changeable, which allows a variety of spaces to be created daily.

Figure 6.31 Mixed Plaza

Flower shops offer one of the best decorations for walkways, especially when the owners put flowers and plants outside the shop. Flowers outside the shop greatly reduce the sense of boundary of the building, and they bring beauty to the walkway. Pedestrians can not only enjoy the visual beauty of flowers, but also enjoy the fragrance.

Figure 6.32 Fragrant Plaza

(4) Improve the comfort level and legibility, to generate the sense of place as well as stimulate activities (figure 6.33)

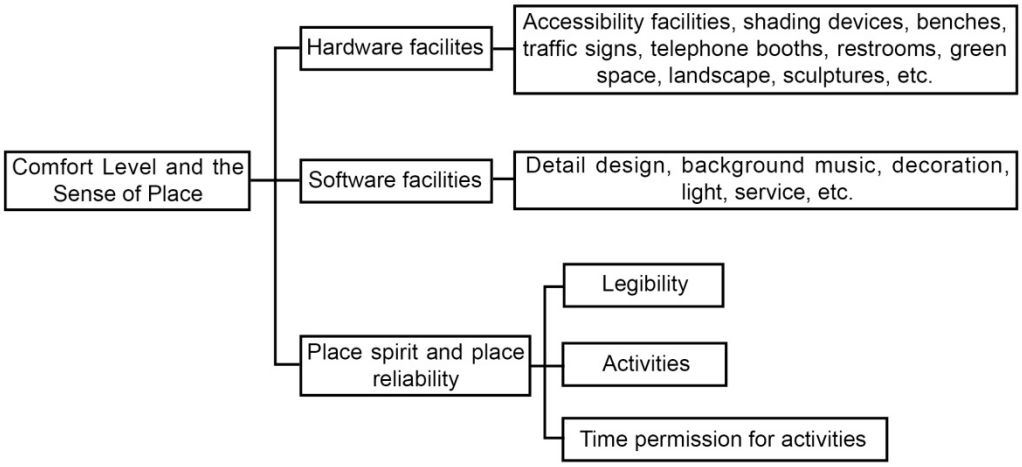


Figure 6.33

There are sufficient elevators in the site, and the shading devices, benches, green space, sculptures greatly increase the comfort level of both exterior and interior spaces (figure 6.34, 6.35. 6.36). The corridor which connects the center circle and the site is unique from the other 4 corridors (figure 4.42, 6.38). Therefore, it is legible and quite obvious for all who visit.

Interior corridors are important elements within the design. They are part of the pedestrian systems, and form transition spaces between walkways and buildings. Normally this type of space is identified for circulation only. In the design, functions such as retail, vending, seating areas and other amenities add greatly to the pedestrian experience. Therefore, the walking experience in these corridors is quite enjoyable. Pedestrians have multiple choices and various emotional responses when walking inside.

Figure 6.34

The walkway is part of the building, there is no clear boundary between interior space of the building and pedestrian system. The two kinds of spaces fuse with each other. People can also take food out to the seating area (on the right of the picture) if they like, from where they can enjoy the view of the courtyard and the active interior corridor as well.

Figure 6.35

The enlarged interior corridor also serves as an informal stage. The space is large enough for people to enjoy the performance and enjoy observing others. The shop on the left sells drinks and cookies, and other food items to add life to the pedestrian system. It is a space for people to stop and take a rest, along with being a great space to socialize and experience street culture.

Figure 6.36

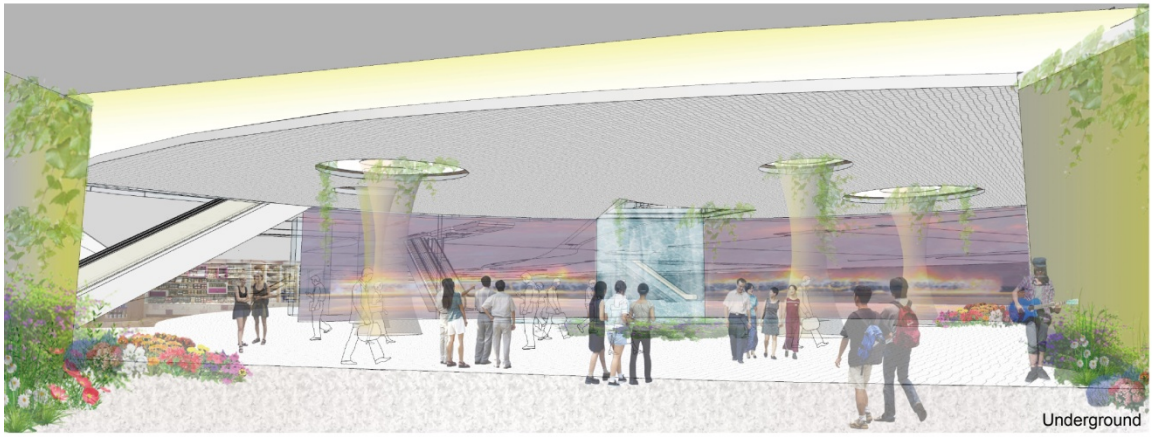
To reinforce sense of place, spaces are created for people to spend time in, hang out with family and friends, and make new friends. Spaces are created for numerous types of people, to meet their needs and to let them feel comfortable and free in that space. The plazas in the site have different qualities and features (figure 6.37). One plaza is a quiet space, another is an energetic space, and the like (figure 6.38 - 6.47). Functions around these plazas support many diverse features. Additionally, space could have changing features during different times, and the surrounding buildings can also respond to the changing spatial features (figure 6.43-6.47).

Figure 6.37

The plaza is the main entrance of the site. There are numerous seating areas, ample green space and paved areas to allow people to socialize and enjoy the urban environment. And it is also an important connector between ground and underground level. The Sun Valley is modeled from The Shanghai Expo, will transfer sun light to underground, in order to make a bright and desirable underground space. Additionally, it serves as a cover for benches and other seating areas. It also collects rain water for later use.

Sun Valley of Shanghai
Expo 2010
www.nipic.com

Bird View



Underground

Figure 6.38 Sunshine Plaza

This is an energetic place. The functions of buildings around the plaza are retail shops, coffee shops, music store, etc, which are popular among most people. The large open space offers a great dancing practice place for youngsters. Because of these activities, the whole area becomes dynamic and full of energy.

Figure 6.39 Dancing Plaza

The fashion plaza is also a dynamic place. Fashion shows are hold on a regular basis. The landscape (water and benches) in the middle of the street defines two kinds of exterior space. For example, one part of the space is for the show and the other is for the audience. Walking along the fashion show place would be a uniquely rewarding experience for general public.

Figure 6.40 Fashion Plaza

The plaza is relatively quiet. Since the functions around are book store, flower shop, clothing shop, they define the space as a place that good for reading and relaxing. The trees provide a paving feeling, which enhance a sense of peace. The keyboard-shape sculpture divides the space into moveable and static spaces, which allows sitting people watch walking people. (Based on research, the No.1 activity in public space is looking at other people.)

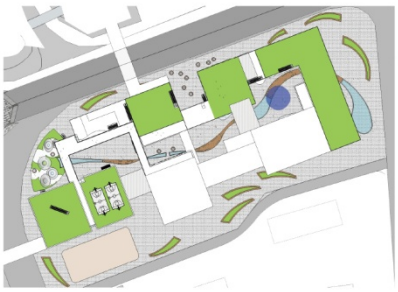


Figure 6.41 Peace Plaza

Here is for pets, and for people to socialize. Everyone will enjoy the place as long as he/she loves pets. It is a great place to make new friends and learn from others.

Figure 6.42 Cute Plaza

The plaza, which directly connects to the bus plaza, forms a popular space for general public. Here is especially for various exhibitions. People could just stroll around here while waiting for buses. Different exhibitions attract different kinds of people, that is how activities define a space and make space diverse. The picture above shows an art exhibition. The half-covered plaza can be regarded as the transit space between the building and exterior.

Figure 6.43 Versatile Plaza

Putting temporary structures into the bus plaza form other kinds of space. A Famers' Market is held here during New Year and other celebrations. All the decorations on the façade of the building as well as the hanging ones create a festive and happy feeling.

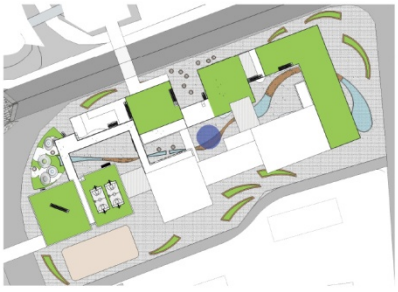
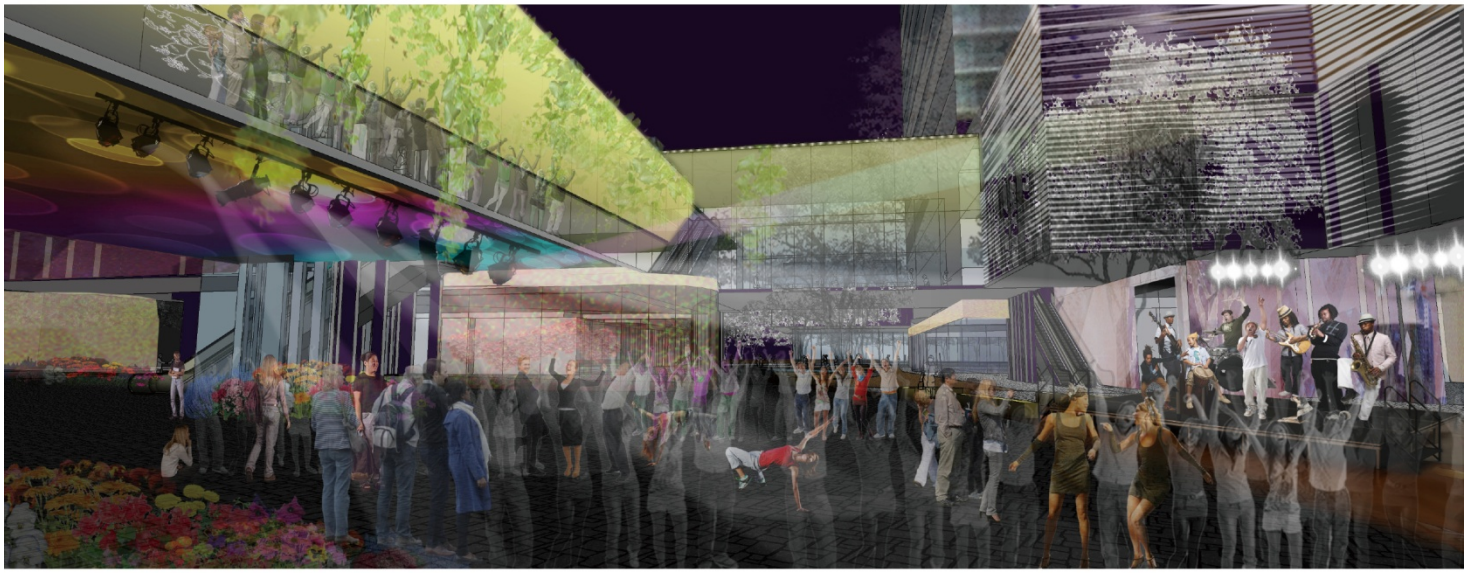


Figure 6.44 Versatile Plaza



During nights, performances and concerts are held here. With the support of buildings and walkways, people enjoy the show from 2 levels, one is the ground level and the other is the elevated level. It becomes a multi-level dynamic space, which enables people to fully experience the entertainment and enjoy the night life of the city.

Figure 6.45 Versatile Plaza

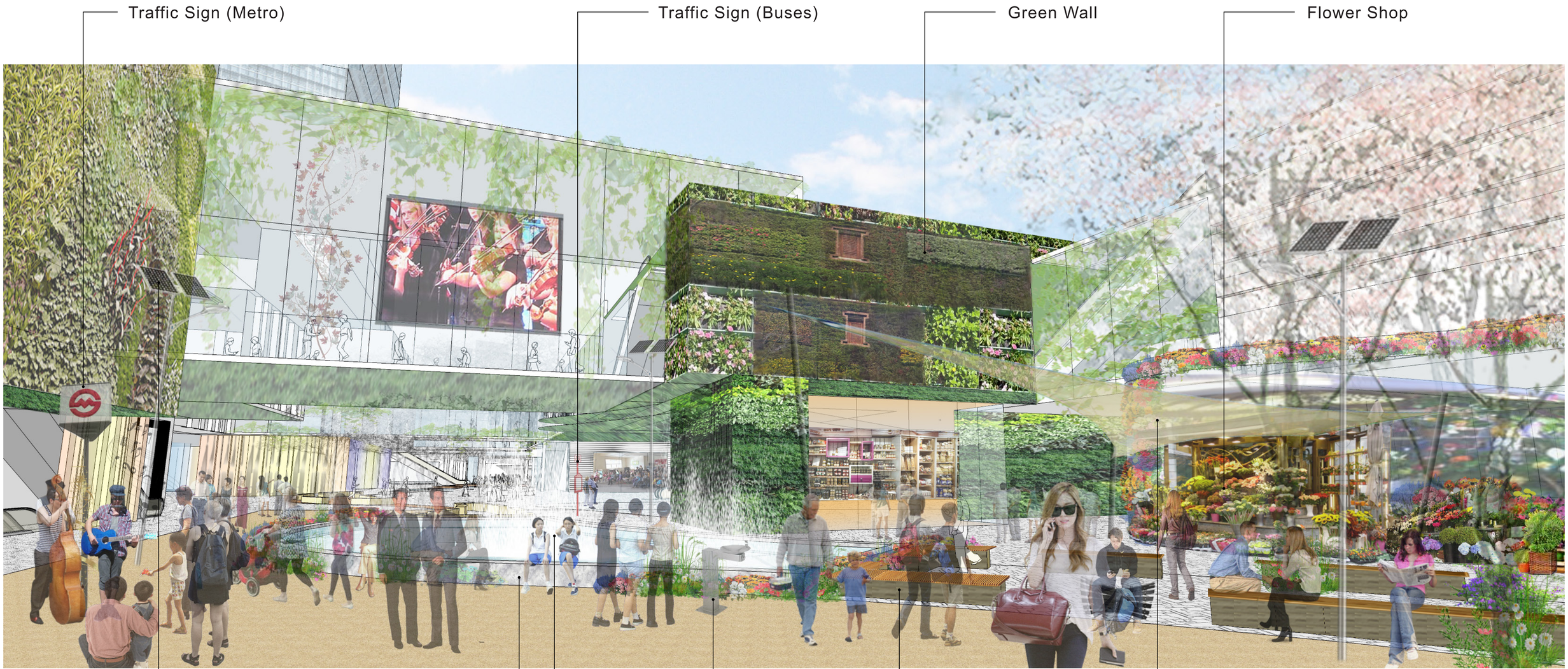
The plaza is for children and teenagers. Since the place is on the south side of the main commercial area, the noise will not affect the adult area. It is proximity to stationery store, a toy store and fast foods. Therefore the functions strongly support this area. The child day care center is on the third floor, so an elevator and a spiral slide have been designed which connect the building with the playground. Also, there is space for parents and elderly to relax and watch children. Children enjoy playing here without worrying about vehicles, and it is a great place to free their mind and body.

Figure 6.46 Dynamic Plaza

During nights, the façade of the building entertains pedestrians. The curtain of the building changes to a film screen and becomes a new attraction in the area. The plaza is the best place for people to enjoy their nights, experiencing the night life of the city.

Figure 6.47 Dynamic Plaza

In the project, buildings not only define the exterior space (the plaza), but also offer functional support to the plaza. The night movies are the dialogue between building and people, it demonstrates how buildings may respond to its surroundings.



Appendix B　Desirable Walking Experience

(5) Maintain the sustainable development of the dynamic system formed by buildings and pedestrian systems (figure 6.48)

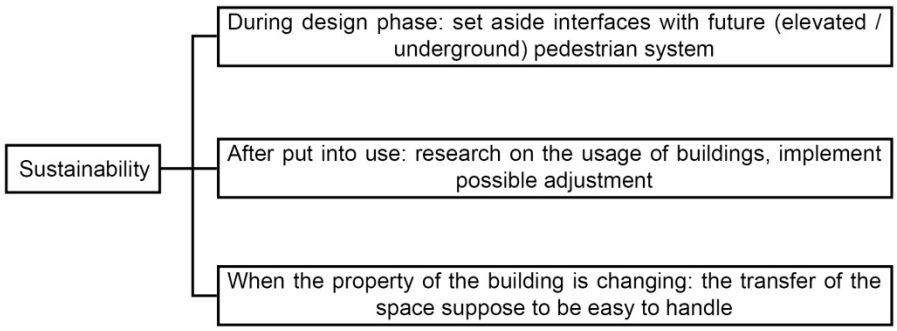


Figure 6.48

Several connections with walkways in the buildings are set aside (showed in the picture below in red), to meet the future needs and possible development (figure 6.49).

Figure 6.49

The ability to transform space is controllable. Public areas within buildings can be easily transformed into private space (figure 6.50)

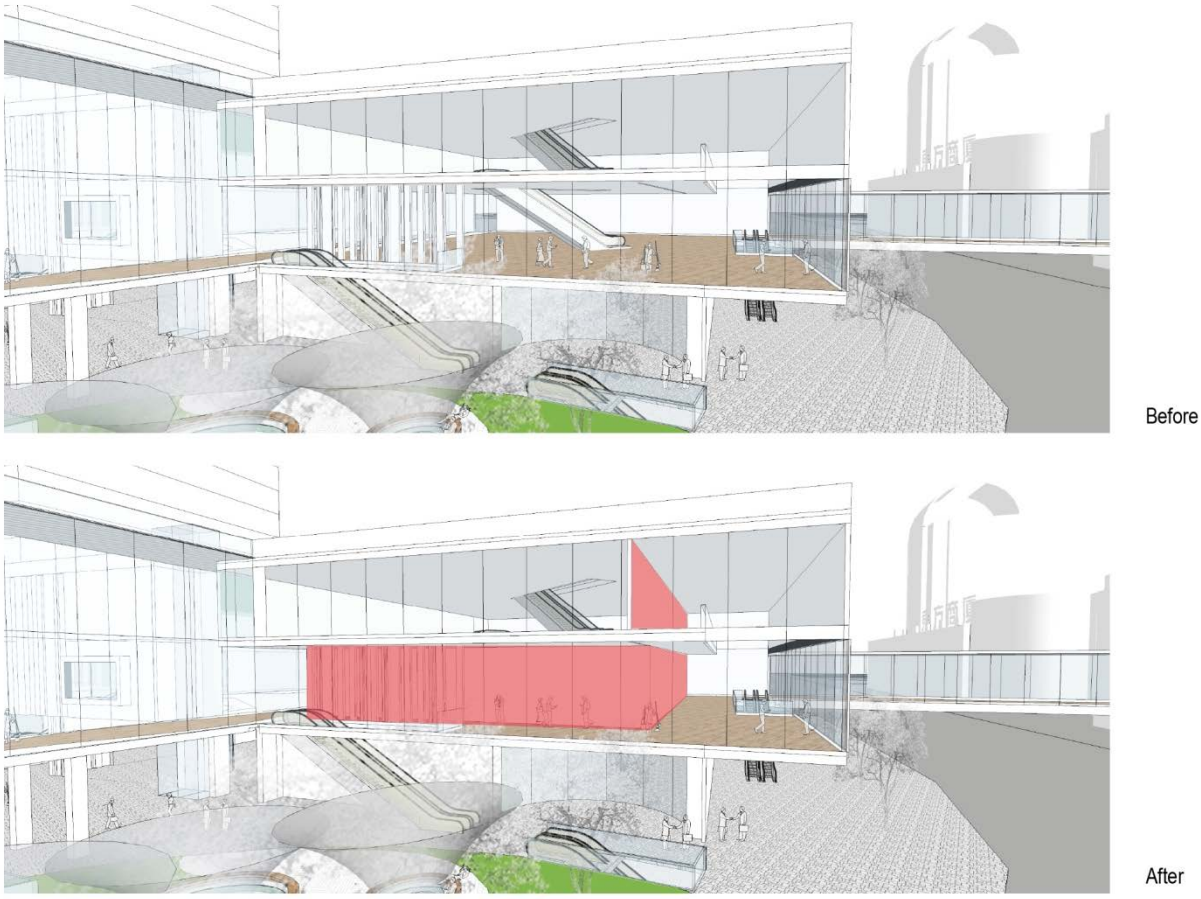


Figure 6.50

(6) Reduce energy consumption in the site

Several energy saving techniques are introduced to reduce the energy consumption within the site.

a. PV on the rooftop (figure 6.51)

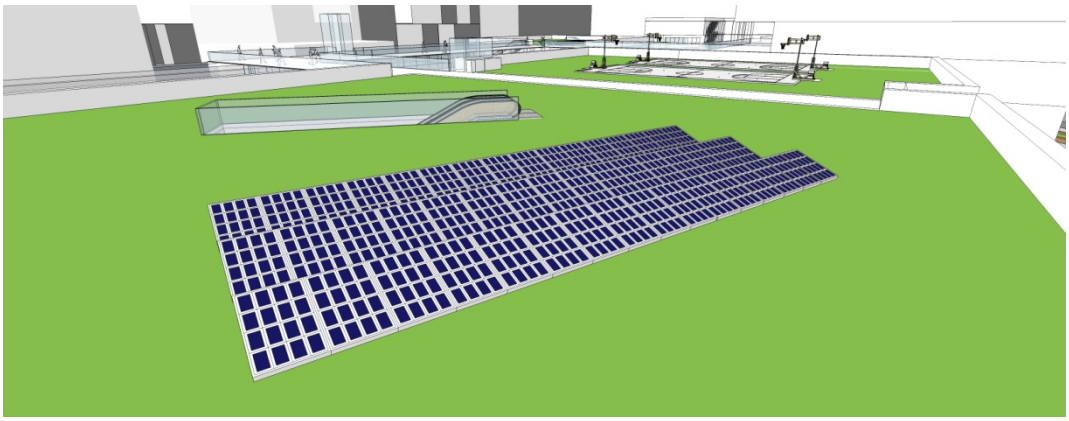


Figure 6.51

b. Rain water collection (sun valley, figure 6.38)

c. Water recycling (figure 6.52)

Figure 6.52

The water recycling system is integrated into landscape, and people can closely observe and experience the process.

d. Open space control

The use of air-conditioning is one of the most energy consuming functions in most buildings. In response, the area that needs air-conditioning was reduced (figure 6.54). Since open and unenclosed spaces are the most important ideas in the design, air curtains (invisible door) are utilized in most of the buildings (figure 6.53)

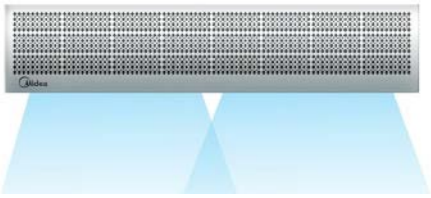


Figure 6.53 Air Curtain

During extreme climate, in order to keep the comfort level of the entire area, a larger coverage of air-conditioning may be needed (figure 6.55). Thus, pedestrians are able to maneuver through the complete Wujiaochang area without being affected by bad weather.

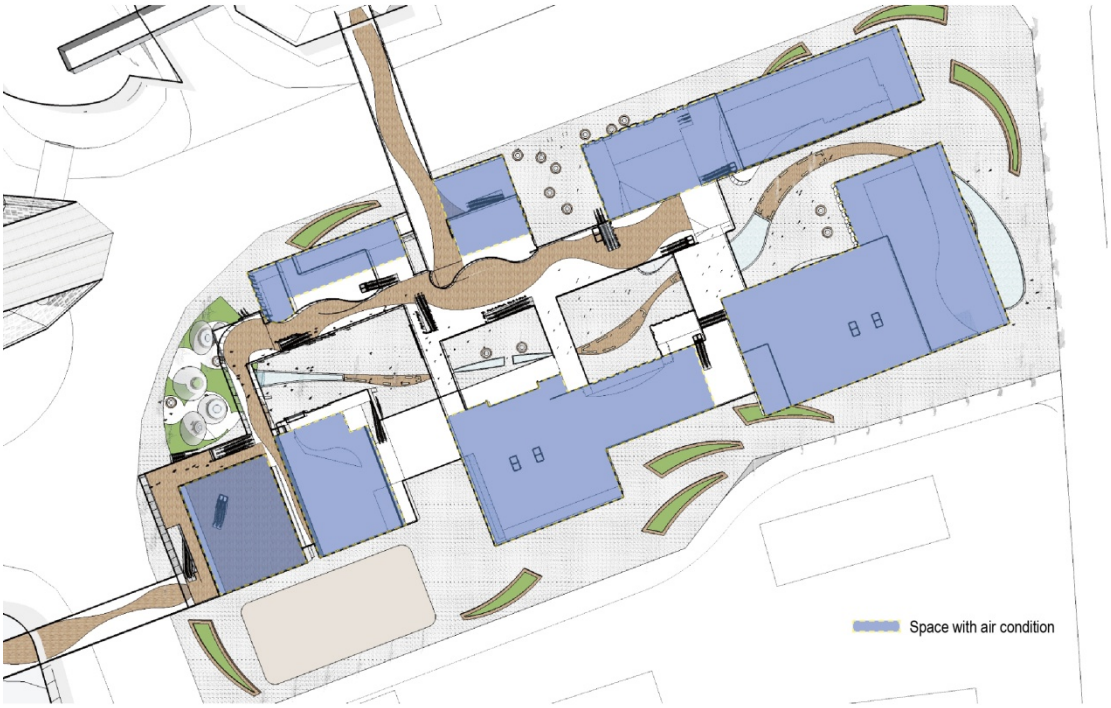


Figure 6.54 Energy Saving Plan

Figure 6.55 Air-conditioning in the Entire Area

Chapter 7 Conclusion and Prospect

7.1 Conclusion

Through analysis of the successful pedestrian circulation systems of Hong Kong, Bangkok and Boston, a variety of connection methods between buildings and pedestrian systems were studied. Additionally, a number of examples were documented where multi-functional buildings support and interact directly with complex pedestrian systems. An Assessment Methodology was independently developed to examine the three precedents along with their urban theoretical approaches. By implementing the Assessment Methodology on the three city centers in Shanghai (Wujiaochang, Yangpu District, Lujiazui, Pudong District and Xujiahui, Xuhui District), the merits and demerits of each city center were summarized. Finally, an urban design strategy focused on pedestrian experience was developed that is based upon the symbiotic relationship between pedestrian systems and architecture. The results are primarily based on the analysis of pedestrian circulation systems in Hong Kong, Bangkok, Boston, and the three city centers in Shanghai. Following are the main study results:

(1) The symbiotic relationships between pedestrian systems and buildings clarify the role of buildings with pedestrian systems, identify the buildings as essential nodes, and unify the pedestrian systems. The symbiotic relationship contributes to the continuity of pedestrian behavior, offers functional support, enhances the efficiency and comfort levels for pedestrians, stimulates socialization and activities in the public space. Consequently, the design intervention dramatically improves the culture of the street. This is especially true in high-density cities where buildings can be utilized to connect pedestrian systems on elevated, ground, and underground levels. The result contributes to a safe, efficient and desirable walking environment. Hence the symbiotic relationship between pedestrian systems and buildings helps to resolve many of the problems that currently exist within pedestrian systems found in high-density cities.

(2) The Assessment Methodology of the symbiotic relationship between pedestrian systems and buildings includes:

a. Continuity of pedestrian behavior supported by buildings

b. Integration degree of the pedestrian spaces and buildings

c. Functional support of the pedestrian circulation systems by buildings

d. Comfort level

e. Sense of place

f. Sustainability / Flexibility

(3) The Design Strategy employed relies upon the symbiotic relationship between pedestrian systems and buildings. This includes:

a. Establish building and pedestrian systems that support the pedestrian environment and interconnect walkways on multiple levels to establish a cohesive and supportive environment;

b. Ensure sufficient connections between buildings and pedestrian systems to fuse both kinds of space;

c. Ensure multi-functional relationships between the buildings and pedestrian systems;

d. Improve the comfort level and legibility to generate the sense of place as well as stimulate activities;

e. Maintain sustainable development of the complex system formed by the building and pedestrian systems.

Finally, based on the analysis, the Design Strategy was implemented and tested in one design study, which utilized the site in Wujiaochang. Since one site within Wujiaochang is still under construction, this provided an opportunity for improving the whole area. I utilized the entire Wujiaochang area and created an elevated level pedestrian system which enhanced the accessibility below ground level and addressed the existing problems found within the underground and ground level pedestrian systems. Later on, the focus was on the southeast corner of the site where the goal was to create an accessible and dynamic place for pedestrians. Therefore, I not only focused on the horizontal circulation, but also emphasized the vertical circulation. I implemented 10 ways that buildings and pedestrian systems could integrate with each other and provide not only convenience, but also very diverse and exciting spaces for pedestrians. In addition to the physical building design, I carefully considered how to define spaces, how people could use the spaces, and what kind of activities might happen in each specific space. With thoughtful arrangement of the functions within the buildings, I created different qualities of space, such as quiet versus energetic spaces, in order to meet the needs of a broad range of users. Additionally, the spaces are flexible and mutually support the surrounding buildings. Spaces alter according to the time (day and night) and accommodate diverse events taking place throughout the urban environment. The goal is to create the sense of place, where people are rewarded through spending time in the "urban streets" and are able to socialize with family and friends and make new acquaintances in a positive way.

Buildings within the site strongly support pedestrian activities through the integration with pedestrian systems and creating a wonderful walking environment. Additionally, the functions of buildings infiltrate into walkways and generate a

dialogue between the pedestrian systems and buildings. In totality they enrich the dynamics of the walkways and help to stimulate a unique and enriching street life.

7.2 Epilogue

In high density city centers, pedestrian systems are consistently interrupted by vehicles. Infrastructures usually conflict with pedestrian spaces and do not support either walking or socialization. Many of these problems can be resolved through establishing a symbiotic relationship between buildings and pedestrian systems. However, the importance of the relationship between buildings and pedestrian systems is usually ignored. Most buildings actually interfere with pedestrian circulation through their failure to integrate with pedestrian systems.

In the design of pedestrian systems in city centers, we should utilize a design strategy that creates a symbiotic relationship between pedestrian systems and buildings. We should fully explore the function of buildings, and the new paradigm that would be of great benefit to most pedestrian systems. Many of the urban problems which exist in today's pedestrian systems in high density city centers could be resolved and our cites and inhabitants would both gain through the process.

Bibliography

[1]. Altucker, K. *Downtown Skywalk Falls into Disfavor*. Cincinnati, 2003(3)
[2]. Robertson Kent A. *Pedestrian Malls and Skywalks: Traffic Separation Strategies in American Downtowns.* Journal of American Planning Association, 1993, Summer93, Vol.59.
[3]. Jon. *Urban Design.* Liaoning: Liaoning Science and Technology Press, 2008(1).
[4]. Wang Songtao, Zhu Yin. *From Sky-bridge System to Aerial Business Street——Take Chongqing Guanyin Street as an Example.* Planners, 1998(3).
[5]. Ye Ming. *CBD and Skywalk Pedestrian System in Hong Kong*. Planners 1999(15).
[6]. Dong Hexuan. *Urban Tridimensionalization: Pragmatic Way to Saving-typed Harmonious City*. The Journal of Architecture, 2008(1).
[7]. Qin Jian. *Analysis on Traffic Demand of Elevated Footpath in Pudong Park of Shanghai World Expo*. Urban Roads Bridges & Flood Control, 2010(3)
[8]. Lu Ke, Pan Haixiao. *Evolution of Pedestrian Environment in Urban Area: Reviews of the Pedestrian Environment Improvement Practice in UK, Germany and USA.* Urban Planning Overseas, 2001(6):39-43.
[9]. Li Pengtao. *Research on Pedestrian Environment in City Center.* Inner Mongolia Science Technology and Economy, 2005(11).
[10]. Mao Yingping, Fu Linli and Lin Tao. *System Planning for Regional All-Weather Pedestrian Facilities: A Case Study of Golden Triangle Area in Luohu District, Shenzhen.* Urban Transport of China, 2011(9):45-51.
[11]. Feng Chunsheng, Tang Weiwei. *To Establish Modern Pedestrian Streets with Country Context——Take Liuzhou as an Example.* Management & Technology of SME, 2011(33).
[12]. Yu Bo, Zhang Yonghui and Lin Yan. *Three-dimensional Development and Land Use in Urban Space.* Journal of Liaoning Technical University, 2004(23).
[13]. Mo Binsen. *Development and Land Use of Underground Space.* Research on Urban Construction, 2011(22).
[14]. Zhu Liangcheng, Lu Shan and Su Yu. *Research of Urban Underground Space Planning Led by TOD.* Urban Transport, 2010:18-22.
[15]. Wang Yueli, Liang Ligang. *Subterranean City: The Introduction of Pedway in Chicago.* Urban Planning International, 2010(25):95-99.
[16]. Lu Jiwei, Gong Haoyuan and Song Yunfeng. *To Establish a Three-dimensional and Efficient Pedestrian System——Take Hangzhou as an Example.* City Planning Review, 2004(6)
[17]. Dong Xiangyang. *Sustainable Pedestrian Environment——Research on the Design of Business Street.* Journal of Huaibei Professional and Technical College, 2006(5)
[18]. Miao Pu. *Urban Design Principles in High Density Environment.* Time Architecture, 2001(3)
[19]. Gao Rong, Yang Changming. *Humanistic renovation in public space of City high-density district.* Chinese and Overseas Architecture, 2003(3)

[20]. Fei Yishan, Wang Jianguo. *Urban Form and Transportation in a High-Density City——Take the Development of Hong Kong as an Example.* New Architecture, 2004(5).
[21]. Zhao Yongwei. *Construction of High Density Coordinated Unit in City Center: Urban Design Strategy with Holistic Adaptability.* Architectural Journal, 2005(7).
[22]. Dong Chunfang. *Architectural Consideration to Urban High Density.* Architectural Journal, 2010(4).
[23]. Wang Zhendong, Chen Yi. *Ecological Strategy in Urban Building Complex Layout under High Residential Density.* Housing Science, 2011(1).
[24]. Li Jiali, Chen Hanyun. *Factors Affecting Urban Renewal in High-Density City: Case Study of Hong Kong*. Urban Insight, 2011(2)
[25]. Chen Keshi, Cui Chong. *Spatial Design in High-Density Urban Centre Districts from Chinese Communities: Complementary Models of CRD and Park in Causeway Bay, Hong Kong*. Modern Urban Research, 2011(8).
[26]. Guo Wei, Hou Xiaolei. *Pedestrian System Strategies in the High-density Downtown——A Case Study on the Hong Kong Central.* Chinese Landscape Architecture, 2011(8).
[27]. Tong Xin, Wang Xiaofan. *The Use of Miniature Public Space Under High-density Environment.* Chinese and Overseas Architecture, 2012(3).
[28]. Zhu Xiaojun. *Return to Human Space——a Brief Talk about Urban Public Space.* Contemporary Construction, 1999(6).
[29]. Du Jia, Hu Zhengyan, Wang Lidan. *New Urbanism and City Public Space Quality.* Huazhong Architecture, 2005(6).
[30]. Wang Rong, Hu Wangshe, Liu Huan. *The discussion of vitality which in complex' s urbanize public space.* Chinese and Overseas Architecture, 2006(3).
[31]. Dong Yu. S*haping the Walkable Urban Open Space*. Huazhong Architecture, 2006(12).
[32]. Qiu Shujjie. *Street Planning Tactics for Urban Public Space.* Architectural Journal, 2007(3).
[33]. Wang Yongfan. *Relationships between city public space and architecture.* Shanxi Architecture, 2007(18).
[34]. Pan Haixiao, Tang Yang, Wu Jinyu. *Spatial Planning Strategy for" Low Carbon Cities" in China.* Urban Planning Forum, 2008(6).
[35]. Sun Tongyu. *Architecture and Unban Public Space under the Regional Leading.* Urbanism and Architecture, 2009(8).
[36]. Liao Fang. *Architectural Design for Urban Public Space.* Shanghai Urban Planning Review, 2011(4)
[37]. Xu Ning, Xu Xiaodong. *Reading Urban Public Space in Hong Kong*. Modern Urban Research, 2012(2).
[38]. Wang Suyi. *Study on the organization of transportation and public space around urban complex.* Engineering and Construction, 2012(2).
[39]. Liu Xiaoxing, Chen Jing. *Enlightenment of Rogers's planning of Lujiazui.* Planners, 2012(9).
[40]. Liu Xiaoxing, Chen Yi. *From State Perspective to Everyday Life*

Perspective——A Research on Urban Spatial Transformation of Lujiazui Central Area. Urban Planning Forum, 2012(3).
[41]. Li Dongjun. *Blueprint Toward of a New Century──CBD Planning of Lujiazui.* Time Architecture, 1997(1).
[42]. Zheng Qi, Tang Zhen. *A Study on Optimization of Traffic Arrangement in Xiaolujiazui Region*. China Municipal Engineering, 2008(2).
[43]. Wu Jiaorong, Chen Xiaohong. *Metro Station Transfer Characteristic and Regional Taffic Improvement.* Urban Mass Transit, 2004(4).
[44]. Li Danfeng, Zhou Jianjia. *Illustrating Traffic Constructions in Shanghai Rapid Urban Expansions.* Time Architecture, 2009(6).
[45]. Gao Qian, Wan Dan, TaoJiming. *The concept on the construction of CBD in Shanghai and Lujiazui-Bund Core CBD.* Scientific Development, 2010(3).
[46]. Gao Shiyun, Long Qiao. *Transit Hub Construction and Its Relative Traffic Plan Exploration in Xujiahui Area.* Underground Engineering and Tunnels, 2007(1).
[47]. Xu Zhengliang, Chen Ye, He *Bin*. *Integrated Development and Utilization of Xujiahui Hub of Shanghai Rail Transit and Its Underground Space.* Time Architecture, 2009(5).
[48]. Zhou Shiyan, Zhang Shiyu. *Evolution of Commercial Forms and Transformation of Space: Analysis of the Business Circles of Sub-CBD of Xujiahui and Wujiaochang in Shanghai.* Time Architecture, 2005(2).
[49]. Ding Juan, Xu Leiqing, Tang Zhong. *Study on Occupant Flow in Underground Public Spaces——A Case Study of Xujiahui Underground Shopping Mall in Shanghai.* Building Science, 2008(9).
[50]. Meng Xiaoyin. *The Characteristics of the Times in Underground Space Development.* Underground Space, 2001(2).
[51]. Shanghai urban planning bureau. *Shanghai Urban Planning Management practice.* China Architecture & Building Press, 2007(42).
[52]. Li Hong. *Collection of Planning for Wujiaochang*. Ideal Space, 2004(2): 58-73.
[53]. Xu Yisong, Wang Yinghe, Fan Yu. *An Example of Planning with the View of Urban Regeneration—the Plan of New Jiangwan in Shanghai*. Urban Planning Forum, 2005(4)
[54]. Cai Suhui, Chen Jiao, Yang Xu. *On public space analysis of Wujiaochang city's sub-center.* Shanxi Architecture, 2010(18).
[55]. Xiao Ling, Yi Weizhong. *Transport Planning for Urban Sub Center—Jiangwan Wujiaochang.* Shanghai Construction Science & Technology, 2007(1).
[56]. Li Ping. *On Circle Traffic Organization Design of Wujiaochang in Shanghai.* China Municipal Engineering, 2010(4).
[57]. Shanghai City Traffic Paper, 2002/06,
http://www.jt.sh.cn/infopub/xxgkml/ghjs/ghjh/info-0007.html.
[58]. Peng Qingyan. *Construction and Applicability of Elevated Pedestrian Facilities.* Urban Transport of China, 2011(11)
[59]. "Climate of Hong Kong". http://www.hko.gov.hk/cis/climahk_c.htm.
[60]. Zhou Yixin. *Comparison between Hong Kong Central and Arcade Buildings.* City, 2010(03).

[61]. “Population of Bangkok (2010)”.
http://worldpopulationreview.com/countries/thailand-population/
[62]. “Improving Conditions for Pedestrians in Bangkok”.
http://www.sutp.org/index.php/component/phocadownload/category/139-sd-cs?download=436:m-king-9up
[63]. Craig Townsend,John Zacharias. *Built environment and pedestrian behavior at rail rapid transit stations in Bangkok.* Springer Science + Business Media, LLC. 2009
[64]. David Morris. *The Sense of Space.* SUNY series in Contemporary Continental Philosophy, 2012 (2)
[65]. Lei Shan. *The Study of the Multi-Level Pedestrian Systems in City Centers.* China Urban Planning Symposia, 2011
[66]. Li Hong. *International design competition for Wujiaochang*. Ideal Space, 2004(2)
[67]. “The Past and Present of Wujiaochang”. Last modified 12 January 2012,
http://sh.focus.cn/news/2007-06-21/326979.html
[68]. Xu Fangchen, Dong Piling. *Design of Underground Space Exploitation in Jiangwan-wujiaochang Subcenter.* Chinese Journal of Underground Space and Engineering, 2006(7)
[69]. Liu Xiaoxing, Chen Yi. *From State Perspective to Everyday Life Perspective-A Research on Urban Spatial Transformation of Lujiazui Central Area.* Urban Planning Forum, 2012(3)
[70]. “Century Bridge”. Last modified 24 April 2011,
http://news.sina.com.cn/o/2011-04-24/040822347370.shtml
[71]. “Shanghai local Chronicles”.
http://www.shtong.gov.cn/node2/node2245/node4482/node54724/node54735/node54788/userobject1ai41077.html
[72]. Ashihara Yoshinobu. *Exterior Design in Architecture.* China Architecture & Building Press, 1985(3)
[73]. Xu Zhengliang, Chen Ye. *Integrated Development and Utilization of Xujiahui Hub of Shanghai Rail Transit and Its Underground Space.* Time Architecture, 2009(5)

List of Figures

Fig.

Original city models of Hong Kong, Bangkok, Boston, Wujiaochang and Lujiazui are downloaded from Google Earth

The other photos, diagrams, pictures are taken/made/drawn by myself.